LOCAL HERPETOLOGICAL KNOWLEDGE IN THE NORTH

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By

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Abstract

Amphibians are important components of ecological communities and of human cultures, even in high northern latitudes where species diversity for this group is low. Despite their ecological and cultural value, and their ability to serve as indicators of ecosystem health, information on the biology of amphibians in Alaska and high latitude segments of their geographic range is limited. By combining local knowledge of herpetology and citizen science approaches, it is possible to circumvent some of the logistical constraints of research in a vast, sparsely populated region to enhance scientific understanding of amphibian populations. The first objective of this investigation is to document the nature and extent of local herpetological knowledge within a rural Alaska community, including perceptions of local human-amphibian relationships. Secondly, this study explores various methods of obtaining this knowledge and engaging the public in citizen science programs for the production of herpetological data. Finally, this study examines the species diversity, distribution and population trends of amphibians in the Stikine River region of Alaska.

I demonstrate that local herpetological knowledge, when combined with standard biological techniques, can be used to better understand amphibian populations in Alaska. This study documented 3,645 amphibian observations in the state, including 2,320 observations contributed by citizen scientists and members of the public. Six native species and three non-native species were included in these observations. I found that each method of data acquisition resulted in varying degrees of efficiency and resulting contributions, and that members of the public were generally willing to share their knowledge of amphibians on local landscapes. The nature and extent of contributor knowledge varied, though many participants provided detailed information on past observations. Many respondents also perceive amphibians as important to local ecosystems and human groups. Contributor observations, combined with data from historic and contemporary herpetological inventories, substantially increase scientific knowledge of amphibians in the Stikine River region of Alaska, and more generally across the state.

Dedication

This scientific work is dedicated to all who have helped me to become the man that I am today. From my family that has helped to raise me and guide me through life's challenges, to my friends that have supported me through some of the most wonderful and most challenging years of my life to date. From my teachers and mentors that have advanced my education and professional development, to all of those who have taught me to be both caring and compassionate in navigating life's adversities. I thank too my pets that have provided endless companionship and unconditional love. Importantly, I also dedicate this work to the Kiks.adi Clan of the Stikine Tlingit - my adopted family in Wrangell. My adopted name "Xíxch'i Toowóo", translated literally as "Frog Feelings" or figuratively as "He Who Cares for the Frogs", has become an integral part of my identity. The friendship and embrace of clan members has allowed me to see the world in another light, and to become the interdisciplinary, culturally sensitive scientist that I am today.

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Resilience and Adaptation Program (RAP), United States Fish and Wildlife Service, United States Forest Service, Wrangell Cooperative Association, and the Wrangell Sentinel.

Chapter 1 General Introduction

Implementing best practices for the management and conservation of wildlife is difficult when data is limited (Mills, 2012). Financial and logistical constraints often prevent the regular use of scientific techniques to understand faunal populations, especially for species that provide limited economic or subsistence benefits to human societies. These species may however be important to ecological communities and to human cultures (Chapin, 2009; Rolston, 2012), and they may also be perceived as having intrinsic value to present and future generations (MacMillan and Phillip, 2008). Alternative data acquisition methods are necessary to supplement biological information when baseline population data is sparse or unavailable. This study examines the use of local and traditional knowledge and citizen science to supplement the collection of biological data for non-consumptive species in Alaska, specifically herpetofauna. It also explores human-amphibian interactions in a rural community, and human perceptions of species within this taxonomic group.

1.1 Ethnobiological Background

According to the Society for Ethnobiology, the ethnobiological discipline is defined as the scientific study of the way that plants and animals are treated or used by different cultures, including exploration of the dynamic relationships between peoples, biota, and environments, from the distant past to the immediate present (Wolverton, 2013). This is an inherently interdisciplinary field that often seeks to document, understand and utilize local and traditional knowledge, as well as western science techniques to improve understanding of the world and human interactions with it. It does necessitate the premise that ways of knowing and understanding the world are diverse and each is no more or less valid than those arising from western traditions.

Irrespective of the scientific tradition that we are oriented toward, all humans have evolved as integral components of social-ecological systems and their relationships with the natural world are important to cultural identity (Berkes and Folke, 1998). Observations of the world are structured through cosmology – perceptions of the origin of the universe (Berkes, 1999) and worldview – a comprehensive and personal philosophy or conception of humans and the natural world (Kawagley, Norris-Tull and Norris-Tull, 1998). Along with worldview, cosmology gives shape to cultural values, ethics, norms for society and norms for human-environmental interactions (Berkes, Colding and Folke, 2000; Skolimowski, 1981).

To understand ethnobiological relationships, we must also understand the ways in which knowledge develops and how the world is perceived. "Knowledge" is a cultural construction derived from continual interaction with an external biological reality that must be accurately understood if societal survival is to be possible (Anderson, 2012). The ways in which this knowledge is sought, documented, and verified is dependent on the cultural setting and often requires that it be more or less accurate, predictive, defined by key postulates, and fluid (Anderson, 2012). It is also as flexible and dynamic as the socio-ecological systems that it is situated within, with the ability to change rapidly in response to system perturbations (Anderson, 2012). Many terms have been used and debated over time to define this knowledge including local knowledge, traditional knowledge, indigenous knowledge, and folk knowledge to name a few, but the premise is that these refer to community-based knowledge of conditions that are often transmitted within culture and through generations (Usher, 2000; Cruikshank, 2007; Ellis, 2005; Huntington, 2005; Bell and Harwood, 2012; Schneider et al., 2015).

The knowledge that results from human-nature relationships can be useful in understanding animal populations. This local and traditional knowledge is defined by the International Council for Scientific Unions as "a cumulative body of knowledge, know-how, practices and representations maintained and developed by peoples with extended histories of interaction with the natural environment" (ICSU, 2002). This knowledge is transferred among residents of a community and obtained through experience, observation, and analysis of natural events (Huntington, 1998; Bell and Harwood, 2012). It is also often interconnected with physical, social, and spiritual aspects of tradition (Cruikshank, 2000).

Local knowledge and western science may inform one another and each has its strengths and weaknesses. Western science embraces positivism, written documentation, detailed statistical analyses, and peer-reviewed dissemination (Barnhardt, 2005). Local knowledge embraces personal and inter-generational knowledge of interactions with the environment that are often holistic, transmitted orally, verified through repetition, disseminated through participant observation and may incorporate spirituality. Where western science is relatively rigid and centered primarily at academic institutions that are often far from the research sites, local knowledge is often more personal and fluid, centered within human communities.

Ethnobiologists often study the religious symbolism of plants and animals (Hunn, 2007), but it is also abundantly clear that extensive cognitive and "scientific" knowledge of species is intertwined (Anderson, 2012). As Anderson (2012) states, traditional people know the difference between well-practiced technical operations and a prayer, with the former being effective because one knows what to do, and the latter being effective only because the gods might possibly listen (Anderson, 2012). Opposition to an inclusive approach to knowledge acquisition has frequently come from positivist traditions that insist on explicit deduction and verification procedures (Kitcher, 1995; Martin and McIntyre, 1994; Popper, 1959). These often include requirements for predictive mathematical modeling and controlled experimentation (Anderson, 2012). These postulates have not always served western science in the pursuit of truth and indeed, many scientific findings have later been discredited (Anderson, 2012). In fact, modern laboratory science is not a perfect flawless pursuit but is as human as any other activity (Latour, 2004, 2005; Merton, 1973; Wimsatt, 2007; Anderson, 2012).

Ultimately there are many similarities among knowledge systems that share a common goal. According to Cruikshank (2001) "Local knowledge of the world… has more similarities with contemporary science than differences from it and we need knowledge bridges that work from local concepts as well as from science if we are to bring broadly based human values to bear on problems such as the conservation of biological and cultural diversity." Both western science and local knowledge are important if they influence the ways that people perceive and interact with their environment (Chapin, 2009).

Another criticism from the positivist tradition is that local and traditional knowledge is often held in a holistic context of culture. Of particular objection is the influence of spirituality and metaphysics which may drive cultural practices. Importantly however, many modern western scientists remain religious or spiritual and some scientific ideas, such as string theory, are so controversial that they are considered by some to be beyond the realm of reality (Anderson, 2012). The fact that spiritual and symbolic connections to knowledge are often demonstrated in myth, ritual, art, and philosophical speculation (Hunn, 2012), need not devalue the underlying importance of knowledge itself. In fact, understanding the world more holistically, with human beings and their culture recognized within these knowledge bases, is more likely to drive policy and human action than a mere assemblage of facts.

Ethnobiological knowledge is considered by many to be too important to ignore and is essential to rural and traditional communities (Anderson, 2012). The unique strengths of this knowledge are derived through its position at the juncture of many disciplines and between worldviews and epistemologies (Wyndham, Lepofsky, and Tiffany, 2011). There is an evolving political awareness that supports increased inclusion of this knowledge in scientific and management practices, which is especially important in northern ecosystems where rapid climate shifts are occurring (Carothers et al., 2014). These shifts are affecting many aspects of social-ecological systems. Documenting local and traditional knowledge provides a valuable opportunity to uncover local concerns, document local impacts, and to develop communication with and among affected groups (Carothers et al., 2014).

An intrinsic component of ethnobiological research is recognition that knowledge of the natural world can be discovered through a variety of cosmologies, including but not limited to the western scientific approach (Quave et al., 2015). Some authors have recognized a critical need for structural system change that allows a greater variety of knowledge systems to play a role in solving social-ecological problems facing the world (e.g. Nabhan, Wyndham, and Lepofsky, 2011). Conservation biologists and ecologists, in particular, recognize the importance of local and traditional knowledge in contemporary conservation efforts (Gagnon and Bertreaux, 2009; Salomon et al., 2007; Wyndham, Lepofsky, and Tiffany, 2011).

Ethnobiology can play an important role in negotiating the gaps between local forms of knowing, academic development, and legal knowledge structures (Wyndham, Lepofsky, and Tiffany, 2011). The resulting knowledge is increasingly included in natural resource management systems, though there are challenges to integrating data that is often qualitative in nature (Carothers et al., 2014). There are also social considerations regarding the collection and use of knowledge – intellectual property rights, hegemonic political relationships, and compartmentalization of knowledge to meet western bureaucratic needs to name a few.

Much of the literature that has come from the field of ethnobiology has focused on traditional knowledge, especially indigenous knowledge, which is cultural knowledge passed through generations. Intergenerational knowledge is not however the only form of local knowledge; knowledge can also be acquired through contemporary personal experience throughout one's lifetime. This contemporary knowledge, including the development of new knowledge through education and participation in collaborative research is the focus of this dissertation. This focus falls squarely within what Nabhan et al. (2011) describe as the fifth stage of Ethnobiology that "provides a seamless gradient between professional science and citizen science that embraces rather than merely describes the many indigenous sciences."

1.2 Local Herpetological Knowledge in Alaska

Where ecological concerns are on the rise and faith in technological solutions is declining, local and traditional knowledge may provide cause for optimism (Menzies, 2006). It has had a significant influence on many research projects and management strategies to date (Huntington, 2000) and many environmental problems are not easily understood using the western scientific approach alone (Berkes, 2004). It is widely recognized that this knowledge can contribute to the conservation of biodiversity (Gadgil, Berkes and Folke, 1993), rare species (Colding, 1998), protected areas (Johannes, 1998) and ecological processes (Alcorn, 1989; Persha, Agrawal and Chhatre, 2011), and to sustainable resource use in general (Schmink, Redford, and Padoch, 1992; Berkes, 1999).

Ethnozoological studies that examine the nature and extent of human relationships with local faunal species have been limited (Ceriaco, 2012), especially those that focus on herpetological taxa. There are noted exceptions to this (e.g. Sasaki, Sasaki and Fox, 2010; Somaweera and Somaweera, 2010; Bertrand, 1997; Prokop, Özel and Uşak, 2009; Tomažič, 2011) but the focus has usually been on relationships with reptiles, especially snakes (Ceriaco, 2012). Knowledge of human-amphibian relationships has been primarily derived from more general ethnographic studies (Ceriaco, 2012).

Emotional responses to animals are important in understanding the retention and articulation of local herpetological knowledge (Nolan et al., 2006). These responses are often derived from folklore, ideas, perceptions and values that can evoke a range of powerful emotions (Ceriaco, 2012; Nolan et al., 2006), originating in experience and enculturation (Baker, 2001). The perceptions are constantly exposed to change (Nolan et al., 2006), with some of the complexities in American cultural attitudes including myths, folklore, frontier experience, religion, economics, social structures, inventions, politics, philosophy, wildlife research, media, conservation, and animal welfare campaigns (Hoage, 1989; Nolan et al., 2006). Nolan et al. (2006) contend that an emotional analog to information processing and retention exists, especially as it pertains to attitudes toward distinct taxonomic groups.

Understanding ethnozoological relationships, including the extent and nature of that knowledge, can be critically important to conservation (Nolan et al., 2006). Strategies must be informed by an understanding of shared beliefs, perceived values, and the importance of human relationships with other species (Nolan et al., 2006). Studies that have examined the fear and disgust responses to reptiles (e.g. Prokop, Özel and Uşak, 2009; Tomažič, 2011) have found that these emotions negatively affect naturalistic and scientific attitudes, but that this fear is mitigated by exposure to these species. I theorize that exposure and resultant attitudes may not only apply to animal husbandry and academics, but also to the development of human-animal relationships through natural encounters on local landscapes and through cultural heritage.

Human-nature interactions have occurred throughout our species history. The "traditional" component of local and traditional knowledge often has a time depth ranging from "living memory (personal experience)" to knowledge that is transferred between several generations (Usher, 2000). This study focused primarily on the acquisition of local and traditional knowledge derived in contemporary observations of and relationships with the natural world. I also sought to foster the continued development of human-animal relationships through education, including the capacity of interested individuals to record their interactions with species in a manner that can be more easily integrated into local management and conservation systems. Using educational programs and citizen science initiatives, stakeholders were provided an opportunity to contribute to the western scientific process. Local participation in research is important for empowering rural communities (Berkes, 2004) and for encouraging small scale conservation efforts that link conservation with local issues (Brosius and Russell, 2003).

Amphibians were chosen as the focal taxonomic group in this study due to the environmental risks facing these species and the known data limitations associated with them in Alaska. Amphibians are among the first and most sensitive taxonomic groups to be impacted by environmental changes (Zug et al., 2001) and baseline biological information on diversity, distribution and abundance for this taxonomic group is limited in Alaska (ADF&G, 2006). Additionally, less attention is paid to these species worldwide as compared to many other groups (McCallum and McCallum, 2006; Mendelson et al., 2006) and they are at risk of being impacted by climate change due to their metabolic associations with the environment and their general inability to migrate over short time periods (McCallum and McCallum, 2006; Parmesan, 2006). Furthermore, while there is no documented economic or subsistence use of these species in Alaska, they are known to be culturally important in some regions of the state (McClellan, 1953; de Laguna, 1972; Beck, 1989; Emmons, 1991).

The Stikine River region of Alaska provides an excellent opportunity to better understand human-amphibian interactions and human observations of ecological change. Much of this region lies within the Stikine-Leconte Wilderness Area and has thus experienced limited anthropogenic development in recent history. Previous herpetological inventories have shown the area to exhibit greater species diversity as compared to other regions of the state (Waters, 1992; Norman and Hassler, 1995). In addition, the nearby communities of Wrangell on Wrangell Island, and Petersburg on Mitkof Island, provide opportunities for engaging the public and exploring amphibian population differences between developed and undeveloped landscapes.

There is a rich cultural tradition in this region that remains the homeland of the Stikine Tlingit Indians (Hodge, 1976; Emmons, 1991). Three local clans of the Tlingit, the Kiks.adi, Kaach.adi and Teeyhittan of the raven moiety, bear the frog as their major crest. This crest was acquired through historical interactions with these species on the landscape (Swanton, 1908). Members of these clans identify closely with the frog and sometimes self-identify as “frogs” in human form. Artistic and ceremonial representations of frogs appear frequently in the region on such items as totems, house poles, regalia, bowls and other culturally important items. They also appear in songs, dances, and stories.

Ownership of a claimed clan crest is of great emotional and spiritual importance to clan members (McClellan, 1953; Olson, 1967; de Laguna, 1972; Emmons, 1991). Crest ownership may not be violated by other clans without permission. This brought the Wrangell Kiks.adi to the brink of war when a newly arrived clan from the Chilkat region arrived in Sitka and attempted to dedicate a frog house in 1902 (de Laguna, 1972; Holmes, 1908; Harring, 1994). Despite ownership customs, several clans throughout Tlingit territory claimed the frog and each took ownership through a traditional interaction with this animal.

Clan stories regarding crest animals were traditionally unique to that clan, though these have sometimes become ubiquitous in recent history. The Wrangell Kiks.adi tell a story about several people who were having difficulty navigating their boats through dense fog at the mouth of the Stikine River. They then heard the chorusing of frogs that led them to safety and dry land. In this story amphibian vocalizations served an important purpose to mankind, and the lesson may have been taught through generations – frog chorusing typically occurs near terrestrial and freshwater habitats. We know that all three native species of frogs in Alaska breed and chorus in many locations at the mouth of the Stikine River.

Clan crests certainly incorporate rules regarding interpersonal relationships but they also serve to dictate appropriate human-animal interactions. The frog appeared in many traditional clan stories that represent these species as powerful and wise animals that can bring about great wealth when treated with kindness but may also cause devastation when violated (Swanton, 1908; McClellan, 1963; de Laguna, 1972; Beck, 1989; Cruikshank, 1992). The powers of the frog spirit were also traditionally appealed to by shamans to aid in healing illness, and members of the frog clans are said to share power and wisdom with these species (de Laguna, 1972; Emmons, 1991). Anthropologists have noted that great respect for frogs among the Tlingit was often combined with great fear (de Laguna, 1972; McClellan, 1975).

This dissertation does not directly address contemporary Kiks.adi relationships to the frog, but knowledge of this relationship's existence over time is important to understanding the context of ethnobiological relationships to these species in the region. It is also important to note that relationships have inevitably changed as a result of acculturation, limited use of the Tlingit language, the influence of Christianity, and other cultural factors. Representations of frogs in Wrangell are however contemporarily present on totems, carvings, and regalia – the community is well aware that frogs are important within the local indigenous culture. Even the local newspaper, the Wrangell Sentinel, uses a depiction of the Kiks.adi shame pole (a pole depicting three large frogs) as its masthead. Tlingit culture remains vibrant in Wrangell even though the 2010 census indicated that only 16% of the communities' population identified as Alaska Native or American Indian alone, and 25% Alaska Native or American Indian in combination with one or more other races (USCB, 2015).

The contemporary relationship of the Stikine Tlingit to the frog is obviously an important consideration as this likely influences the broader community's understanding and perceptions of amphibians. I am currently investigating these relationships through key respondent interviews with Kiks.adi culture bearers in the community. This ongoing work seeks to describe the modern Kiks.adi relationship with the frog, cultural perceptions, attitudes and beliefs toward these species, and cultural teachings that can enhance conservation of this taxonomic group. These findings will then be compared with historical relationships described in available literature. The results of this will enhance understanding of the ethnobiological relationships and local knowledge presented in this dissertation.

It is important to note that I recognize the holistic nature and intrinsic value of local and traditional knowledge regardless of its ability to easily inform western scientific inquiry. This knowledge contains wisdom that encourages the development of values, attitudes, habits, and actions for respectful interactions and relationships with the natural environment (Corsiglia, 2006). Cultural connections with nature are powerful social forces that can "foster stewardship and social-ecological sustainability" (Berkes and Folke, 1998; Chapin, 2009).

1.3 Collaborative Research & Cross-Team Learning

Citizen science programs can produce ecological knowledge using volunteer labor. These programs may serve to train local people to participate in ecological research and they promote connectivity between people and the environment (Devictor et al., 2010). Documenting historical cultural connections with nature and promoting new relationships through stakeholder participation in research often fosters stewardship and social-ecological sustainability (Chapin, 2009).

Many species have benefited from citizen science programs that enhance conservation (Greenwood, 2007). To understand the utility of using local and traditional knowledge and citizen science to study amphibians in Alaska, this study used a variety of methods to engage the public in pursuit of biological data. I also sought to document the nature and extent of human-amphibian interactions to better understand how this influences the development of local and traditional knowledge. Furthermore, understanding these cultural connections can be important for motivating conservation (Chapin, 2009).

Local knowledge can be obtained by several methods and collaborative approaches to its acquisition are now common. This dissertation research included a significant focus on public education and outreach as collaborative tools to documenting local knowledge, cooperatively collecting biological data, and fostering ethnobiological relationships. There is extensive literature on the need to connect students intimately with nature, especially non-traditional and minority students (Bennett, 2005; Henderson et al., 2012; Loving, 1998; McClatchey et al., 2013; Quave et al., 2015). Investigating the interconnectedness of humans and environments can help to guide students to realize their own relationship with both science and the natural world (Quave et al., 2015).

Local and traditional knowledge is often taught through stories, songs, physical participation in activities and other methods that engage the emotional, aesthetic, physical and cognitive portions of experience (Anderson, 2012). It provides for richer, fuller engagement with the world in contrast to educational systems that emphasize memorization in a classroom (Anderson, 2012). Using a team approach to citizen science that includes researchers, youth, educators and other partners can also produce contributions that extend beyond what might have been produced alone (Schneider et al., 2015).

Community involvement in the research process can help to engage the public and to improve working relationships and collaborations (Gearheard and Shirley, 2007). Such interactions are known to foster trust, mutual understanding, and ecological insights (Parrado-Rosselli, 2007; Huntington et al., 2011). Several collaborative approach models have been implemented, including the five-step model proposed by Bell and Harwood (2012) for harvest-based monitoring among the Inuvialuit peoples of the Canadian arctic. This model incorporates the input and protocols of project partners in each stage – formulating the question, designing the program, determining roles for field work, and analyzing data and reporting results.

Other collaborative models are geared toward engagement with citizen scientists within previously established research regimes. Collaborative citizen science projects have been particularly successful in advancing scientific knowledge and have led to extensive datasets on species diversity and distribution around the world (Bonney et al., 2009). Such programs have been indispensable in coupling ecological research with environmental education and natural history observation (Dickinson et al., 2012).

According to Schneider et al. (2015), there are two key ingredients to a cross-team approach model – a personal investment in the research and a recognizable contribution and connection to the findings for all team members. These authors also suggest that successful collaboration requires research that is oriented toward local team members' needs. The challenge in these collaborative approaches is to find areas of common interest where knowledge can be shared and then to design appropriate formats to return information to the community (Schneider et al., 2015). The ultimate structure of the approach can often be dependent on community concerns, local expertise, logistics, financial remunerations, social interaction, relationships with team members, cultural protocols, and scientific interests (Schneider et al., 2015).

This project partnered with several local organizations to provide public education and citizen science programming including the Girls Scouts of Alaska, Petersburg High School, Petersburg Rainforest Festival committee, Muskeg Meadows Golf Course, the U.S. Forest Service – Wrangell Ranger District, and the National Park Service. The resulting citizen science programs (CampPhibian, AmphiBlitz, and Petersburg Service Learning Program) followed the Cornell Laboratory of Ornithology's 9-step model for developing these initiatives (Bonney et al., 2009):

1. Choose a scientific question
2. Form a scientist/educator/technologist/evaluator team
3. Develop, test, and refine protocols, data forms, and educational support materials
4. Recruit participants
5. Train participants
6. Accept, edit, and display data
7. Analyze and interpret data
8. Disseminate results
9. Measure outcomes

The collaborative public outreach and education components of this research were also well-aligned with the cross-team learning model. While the premise or "scientific interest" was to expand knowledge of ethnobiological relationships and herpetological distribution and diversity, local partners played a role in each stage of the research process. During the design of these partnerships, teachers and group leaders guided specific research questions toward those that aligned well with mandated academic curricula. In Petersburg for example, students were engaged in herpetological projects that explored wetland health and productivity, topics being addressed concurrently in the classroom. In Wrangell, the girl scout troop with which I worked was interested in contributing to and learning about ongoing scientific studies in the region in order to earn merit badges. The selection of appropriate field sites was based, in part, on the opportunity for this troop to earn additional badges pertaining to wilderness camping and survival.

Project partners participated in not only the design of the projects, but also in implementation, analysis of data, and dissemination. The Petersburg students used the project's resultant data in the classroom to study statistical methods, scientific reporting, and mapping. Student reports were provided to the Alaska Herpetological Society and disseminated to the Alaska Forum on the Environment (AFE). The Wrangell girl scouts presented their findings from the Camp'Phibian program at the annual meeting of AFE in Anchorage, AK. In addition, I presented the results of these projects at several public presentations in both Wrangell and Petersburg, and result summaries (Appendix G) were also distributed widely within these communities. Radio broadcasts and local newspaper articles were also used to disseminate the work. Schneider et al. (2015) described dissemination as an implicit responsibility, especially in providing results to the community in a form that is understandable and relevant to local audiences.

Citizen science programs and the ecological data resulting from these are increasingly collaborative and support public participation in resource stewardship (Dickinson et al., 2012). The outcomes of collaborative programs, including related management decisions, are often realized at the community level (Bell and Harwood, 2012). It is my hope that this project has positively influenced conservation and education in the Stikine River region and that the results of this research will be beneficial to managers that are interested in amphibian populations in Alaska.

The research presented here underscores the applied, interdisciplinary, and collaborative nature of the "fifth stage" of ethnobiology. It successfully integrates local knowledge, traditional knowledge and western science to realize contemporary relationships between humans and herpetofauna as well as traditional values that can support herpetological conservation and education. The applied nature of this research has utilized many partners and has embraced engaged, participatory approaches, exemplifying what Nabhan et al. (2011) describe as a "seamless gradient between professional science and citizen science." These approaches may be expanded upon to successfully drive contemporary ethnobiological inquiry, including the documentation of contemporary relationships and associated knowledge development with species that are not directly consumed by humans but that may play important roles in social-ecological systems.

The use of local knowledge and citizen science as ethnobiological techniques are highlighted in the subsequent chapters of this dissertation. In chapter two, several methods were used to access local and traditional knowledge of amphibians observed throughout participant lifetimes. Chapter three explores the use of one of these methods, the mailed survey instrument, to gauge the availability of local herpetological knowledge as well as the nature and extent of human-amphibian interactions and associated perceptions. Chapters four and five investigate the use of citizen science, educational programs, and cross-team learning techniques to document faunal occurrence, distribution and life histories of amphibians on local landscapes. Chapter six uses western science techniques to document local populations of herpetofauna.

The overall goal of this study was to better understand amphibian populations in Alaska, primarily within the Stikine River Region. This objective was met, in part, by exploring a variety of interdisciplinary methods to document historical and contemporary observations of and relationships with herpetofauna. The study furthermore expanded cross-team learning opportunities and increased the capacity of community-based observations to enhance herpetological knowledge and conservation in the state.

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Chapter 2 Local Herpetological Knowledge in Alaska: Utilizing Resident Observations to Understand Herpetofaunal Distributions[1]

2.1 Abstract

Local and traditional ecological knowledge is increasingly recognized as a valuable tool in the study of fish and wildlife populations, but rarely has it been applied to non-game species in the North. In Alaska, ecological data for the state's six known native species of amphibians is sparse. Local herpetological knowledge (LHK) may provide an alternative means of acquiring population data for these species. This project tested several methods for acquiring LHK from residents of the state. A total of 1,151 individual amphibian observations were contributed by members of the public. Contributors also presented perceptions of population stability and breeding activity over time. Furthermore, key respondents within the Kiks.adi clan of the Stikine Tlingit offered insights on traditional and contemporary relationships with these species. These data substantially advance herpetological knowledge in Alaska and provide insights for future research and management of herpetofauna.

2.2 Introduction

Knowledge of amphibian diversity, distribution, and population dynamics over time is largely unavailable for species occurring in Alaska (ADFG, 2006). Amphibian monitoring in the state, though conducted rarely, has most frequently included only 1-2 year sampling regimes, and the collection of population metrics for these was often tangential to the research focus. Programs with a broader temporal range of study, such as those conducted by the U.S. Fish and Wildlife Service (USFWS) on the Kenai Peninsula, and the statewide Wood Frog Monitoring Program conducted by the Alaska Department of Fish and Game (ADF&G), have focused entirely on the state's most widely distributed species, the Wood Frogs (*Lithobates (Rana) sylvaticus* [LeConte, 1825]. In 2014, the Alaska Herpetological Society (AHS) instituted the Stikine Long-term Amphibian Monitoring Program (SLAMP), which maintains data from a series of annual inventories and citizen science programs conducted in the Stikine River region of southeast Alaska. This program used data reported by Waters (1992), Norman and Hassler (1995), and this study as a baseline for understanding population trends in the region. Despite the efforts of these programs, amphibian population data for most of the state remains severely limited.

[1] Ream, J.T. and C. Carothers. 2016. Local Herpetological Knowledge in Alaska: Utilizing Resident Observations to Understand Herpetofaunal Distributions. *In-prep*.

Given the financial and logistical challenges of research in the sparsely populated and vast landscapes of the north, local and traditional ecological knowledge (LTK) can serve as an alternative or supplemental means of acquiring ecological data (Thornton and Scheer, 2012). This is knowledge gained by experience, observation, and analysis of natural events and it is transferred among residents of a community (Huntington, 1998; Bell and Harwood, 2012). It is tacit knowledge embodied in life experience (Cruikshank, 2007) that can offer a broader scope of ecological values, practices and information (Ellis, 2005) as compared to controlled experiments.

Local and traditional knowledge, coupled with citizen science initiatives, is increasingly utilized in the north, primarily for species that are harvested for human consumption (e.g., Murray et al., 2008; Nielsen, 2009; Lemelin et al., 2010; Carter and Nielsen, 2011). Local knowledge can also provide a greater temporal range of data since the proximity of residents to a given resource gives both individuals and communities the ability to observe day-to-day and year-to-year changes (Berkes et al., 2000; Usher, 2000). People who have lived in a particular location for many years form a repetitive interaction with the environment, and many build upon generations of accumulated knowledge within a local cultural context. Paul Nadasdy (2006) described the temporal benefit of utilizing LTK:

> "Elders and hunters do not cover as much ground in a single day as do biologists in a helicopter perhaps, but they see animals all year round and have a good idea of what animals do and where they are throughout the entire year, rather than on a single day in June."

The availability and utility of LTK may also serve to advance the study of non-game species where baseline population data and trends over time are largely unavailable or difficult to access, as is the case for amphibians in Alaska. While Alaska is home to at least six native species of amphibians, including three anurans and three urodeles (Hodge, 1976; MacDonald and Cook, 2007), as well as two introduced anuran species, few studies have extensively employed LTK as a means of acquiring extensive and detailed data for this taxonomic group (e.g., Carstensen et al., 2003). To specify the taxa-specific knowledge, we utilize the term Local Herpetological Knowledge (LTK) in this paper.

Discovery Southeast is among the few groups to have utilized LHK in the study of amphibians in Alaska thus far (Carstensen et al., 2003). This study utilized LHK to acquire 430 amphibian records from local residents in Juneau, Alaska. The collection of this data was in part accessed by hosting a “toad party” citizen science event at the Mendenhall Public Library in November of 2002. The authors reported that they found events of this type to be “highly effective, not only in collecting amphibian sightings, but in public outreach as well.” Despite the success of the LHK methodology, this was but a small component of the study’s overall sampling strategy.

The acquisition of LHK can be accomplished by a multitude of methods that may be substantially more economical as compared to active sampling strategies. These methods may not require dedicated researcher travel to field locations. They also have the added benefits of providing public outreach and education opportunities, allowing local stakeholder groups to participate in the research and management of local species, and increasing the recruitment community volunteers and support for future monitoring efforts. Here we report on the use of mailed surveys, in-person surveys, and electronic communication to acquire LHK of amphibians on Alaska’s landscapes.

2.3 Materials and Methods

This study recorded herpetological knowledge contained in local observations of these species over time. All observations made in the state of Alaska were recorded and mapped. The sample of participants was opportunistic for all collection methods except the mailed survey (Appendix C). The mailed survey targeted all households in the community of Wrangell in southeast Alaska. Our emphasis on the Stikine River region was to support concurrent work to document amphibian species diversity and population trends in the vicinity, and to compare this information with historic herpetological inventories in the area (Hodge, 1976; Waters, 1992; Norman and Hassler, 1995).

Wrangell was chosen as a target community in this study due to its proximity to the Stikine River delta and the community’s close cultural ties to amphibians (Hodge, 1976; Emmons, 1991). The Kiks.adi, Kaach.adi, and Teeyhittan clans of the Stikine Tlingit Indians claim the frog as their crest and images of anurans appear on local totems, regalia, and other culturally significant items. We propose that these cultural connections to herpetofauna may serve to increase the extent of resident LHK and promote increased participation in project activities.

2.3.1 Collection Methods

A variety of data collection methods were used in this study to document local observations of amphibians in Alaska over time, including: website submissions, in-person subsistence surveys seeking statewide amphibian observations, and a series of mailed surveys targeting amphibian observations from the Stikine River Region of Alaska.

2.3.1.1 Mailed Surveys

A written survey form was developed as a tool for collecting herpetological data from a target audience. The survey instrument included several questions pertaining to respondents' lifelong observations of amphibians in Alaska. It also contained a photographic species guide to assist with species identification. To gauge the utility of the survey instrument and to identify problematic or ambiguous wording, the survey was tested with twelve undergraduate students at the University of Alaska Fairbanks. These students were enrolled in a 100-level Native Cultures of Alaska course during the spring semester of 2010. The survey was administered on 25 March 2010 following a classroom presentation on the state's amphibians. Some statewide observations were provided by the students and are included here.

A survey instrument was developed to ascertain two primary components of Local Herpetological Knowledge. The first of these are a series of questions pertaining to specific, locational observations of amphibians on local landscapes over time; these locational records are reported in this chapter. The second includes a series of questions pertaining to human-amphibian relationships, perceptions of the importance of amphibians to local ecological and human communities, perceptions of stressors on local amphibian populations and their habitats, and local observations of climate related changes. The latter question foci are reported on in chapter three (Ream and Carothers, 2016).

The survey instrument was designed based on insight from the classroom survey pre-test. Modifications to the classroom survey were made to address results and student recommendations, and questions were changed to target households rather than individuals. Two local maps were added to the instrument including one of the United States portion of the Stikine River and another of Wrangell Island and nearby terrain; both maps were at a 1:500,000 scales. Respondents were asked to mark locations where individual amphibian species have been observed.

In February of 2012, a total 1,296 amphibian surveys were sent to each registered post office (PO) box in the community of Wrangell. This includes 1,144 PO boxes designated as "residential" and 152 boxes registered as "business" (USPS, 2012). Surveys were sent to both box designations to ensure that it would be included with any mail forwarding for residents temporarily out of town. Postal mail in Wrangell is delivered solely to PO boxes that must be paid for by residents, and it is possible that not all residents have access to these boxes or that some households maintain multiple boxes. The survey asked that only one survey per household be completed. This was the closest approximation to a census that was available for the community at that time.

Most questions in the survey targeted all members of the respondent household, though some demographic questions were specific to the respondent. According to the 2010 United States census (USCB, 2015), there were 2,369 residents and 1,053 occupied households in Wrangell that year. The Alaska Department of Labor and Workforce Development (ADLWD, 2015) also publishes annual population estimates in years that do not have a federal census, but these do not include an estimate of occupied households. The 2012 population estimate for Wrangell was 2,445. Assuming the ratio of occupied households to residents was equivalent in 2010, we estimated 1,087 occupied households in Wrangell in 2012.

To increase response rate, elements of the Dillman Total Design Survey Method (Dillman, 2000) were implemented including a preliminary postcard announcing the survey, pastel-colored cover sheets with individual ink signatures, monetary incentives (inclusion of a $1 bill), first-class postage, personal return address labels, and postcard reminders. The survey was promoted in the local newspaper, local radio station, community bulletin boards and in-person survey completion booths held at the local public library. In addition, a Facebook ad campaign targeting all Facebook users in the community of Wrangell was utilized for a one-month period. This ad thanked everyone who responded and reminded residents to complete the survey. A web link directed internet users to an online version of the survey.

2.3.1.2 Follow-up Surveys

In February of 2013 a follow-up survey was sent to a random sample of 25% (n=73) of the 2012 mailed survey respondents in Wrangell, Alaska (Appendix D). The sampling frame was chosen with the assumption that households that previously responded would be more likely to respond again, given previous investment in the project. Four of these surveys were returned by the postal service with the message "vacant box" and four additional postal boxes were sent the survey to replace those associated with vacant boxes. These follow-up surveys sought to document household amphibian observations made in 2012.

2.3.1.3 Other Methods

Several other methods were used to acquire resident amphibian observations opportunistically. These methods include the use of a website form, in-person observation reports, emailed reports, observations received through the U.S. mail, and questions attached to the Alaska Department of Fish and Game subsistence surveys.

The website form contributions were obtained through the Alaska Herpetological Society (AHS)[2] website that seeks public observational amphibian data submission. This data has been available for inclusion in this study since the site's inception in 2012. Some respondents submitting data via this web form also chose to provide observation photographs in emails subsequent to the form submission. All records reported through this system through early 2015 are reported here.

Subsistence surveys were conducted by the Division of Subsistence at the Alaska Department of Fish and Game (ADF&G), and provided an opportunity to opportunistically ask rural residents about their local amphibian observations following a regularly administered comprehensive subsistence harvest survey. This provided observational data from Alaska residents who otherwise would have been difficult and costly to access. Respondents were asked to describe life-long amphibian observations and to identify specific map locations for these. The questions were asked in the southcentral and southeastern Alaska communities of Angoon, Chase, Hoonah, Lake Louise, McCarthy, Paxson, Pedro Bay, Petersburg, Skwentna, Tolsona, Talkeetna, Trapper Creek, and Wrangell.

Key respondent interviews were also conducted among culture bearers of the Kiks.adi clan of the Stikine Tlingit, as well as with several members of the general public. These interviews sought to document local observations of amphibians, but also to better understand historical and contemporary cultural relationships with these species. We touch briefly on the results of these

[2] Submission form available at http://www.akherpsociety.org/vouchersubmission.htm.

surveys here and an in-depth ethnographic account of this relationship will be prepared for a subsequent manuscript outside of this dissertation.

2.4 Results

A total of 1,151 individual amphibian observations in Alaska were recorded for six native species, three introduced species, and unspecified amphibians (Table 1). An additional 53 reports of amphibian “chorusing” and 40 observations of tadpoles were contributed. Respondents also provided 188 photographs associated with their amphibian observations. The greatest number of observations was recorded from the mailed survey representing 74.9% of overall observations. Sampling methods contributed to the regional composition of observations, and given that the mailed survey targeted the community of Wrangell, a large number of observations originated in that community. *Anaxyrus* (*Bufo) boreas* (Baird and Girard, 1852) represented the most frequently reported species (n=354) followed by *Taricha granulosa* (Skilton, 1849) (n=230), unspecified Anura spp. (n=179), and *Lithobates* (*Rana) sylvaticus* (n=143). The number of amphibians reported for each species varied by collection method and region.

An additional 86 observations were recorded on perceptions of local amphibian populations over time (Table 2). The highest proportion of these observations reported that amphibians are “abundant” near the respondent’s local community (n=38), followed closely by observations of local amphibian “decline” (n=37). Only eight households reported a local absence of amphibians while only 3 households reported an increase in local amphibian populations.

The majority of amphibian observations recorded in this study (91%) were made in Southeastern Alaska (Table 3). This was followed by 46 observations from the Copper River Basin, 38 observations from Southcentral, 12 observations from the Interior, 6 from Prince William Sound, 4 from Southwest and 1 from Northwest Alaska. There were no observations made in northeastern Alaska. *Lithobates* (*Rana) sylvaticus* was reported from the Copper River Basin (n=46), Interior (n=4), Southcentral (n=35), and Southeast regions (n=58). *Anaxyrus* (*Bufo) boreas* was also reported in Prince William Sound (n=5), the Interior (n=1), and the Southwest (n=1). This species represented the only other amphibian reported outside of Southeast Alaska.

Wrangell Island observations made up 50% (n=553) of contributed observations from Southeast Alaska and 45% of overall observations. Prior to this study, only *A. boreas* and *T. granulosa* had been reported from Wrangell Island (e.g., Waters, 1992; Norman and Hassler, 1995; Ream and Lopez, 2016). These species were reported most frequently on Wrangell Island in this study, with 149 and 156 observations respectively. Observations of four additional species on Wrangell Island were contributed, including *Rana luteiventris* (Thompson, 1913) (n=51), *Ambystoma macrodactylum* (Baird, 1850) (n=31), *L. sylvaticus* (n=20), and *Ambystoma gracile* (Baird, 1859) (n=8). A photographic voucher of *R. luteiventris* was provided by one respondent and is the first verified account of this species on Wrangell Island.

The second most frequently reported region for amphibian contributions was the Stikine River (n=304). All six of Alaska's native amphibians were also reported on the Stikine River by respondents including *A. boreas* (n=121), *L. sylvaticus* (n=29), *R. luteiventris* (n=24), *T. granulosa* (n=22), *A. macrodactylum* (n=13) and *A. gracile* (n=2). Additional observations were made of unspecified amphibians (n=29), unspecified anurans (n=61) and unspecified caudates (n=3). The greatest number of overall observations on the Stikine River were at Twin Lakes (also called Figure Eight Lake; n=75), Shakes' Hot Springs (n=61), and Farm Island (n=57). *Anaxyrus boreas* was reported most frequently at Farm Island (n=29), *R. luteiventris* at Twin Lakes (n=9), *L. sylvaticus* at Shakes' Hot Springs (n=8), *T. granulosa* at both Farm Island and Shakes' Hot Springs (n=5), *A. macrodactylum* at Farm Island (n=3), and *A. gracile* at both Twin Lakes and Limb Island (n=1).

Two important observations were made of non-native species of adult amphibians in Alaska – *Pseudacris regilla* (Baird and Girard, 1852; see photograph in Appendix Figure E.7) and *Ambystoma laterale* (Hallowell, 1856; see photograph in Appendix Figure E.4). In both cases, photographic and organismal evidence was provided. The *P. regilla* specimen was found on a seafood shipping container in Wrangell, Alaska in July of 2014. The *A. laterale* specimen was found under a flower pot in Chugiak, Alaska on 7 May 2013. This individual was determined to have been released along with five other individuals of the same species in the fall of 2012. The animals originated in Wisconsin and were intentionally introduced by a local resident to "establish a population."

2.4.1 Mailed Surveys

Fourteen amphibian observations were reported by the twelve students completing the pilot classroom survey. One student reported an observation of *A. boreas* near the community of Pilot

Station in southwestern Alaska. All other observations were listed as Anura spp. because students reported uncertainty in their abilty to accurately identify species. Several notes in the margins of these surveys suggest that the students likely reported observations of *L. sylvaticus*.

The targeted Wrangell mailed surveys resulted in many more amphibian observations. A total of 280 completed surveys were returned resulting in a response rate of 25.8% (n=1,087). The mean age of respondents and the mean duration of respondent residency in Wrangell were 52 years and 27 years respectively. Among the returned surveys, 190 households reported 862 amphibian observations associated with spatial data (Table 1) and this represents 74.9% of overall observations. These localities in the Stikine Region are broadly represented in figure 1.

Anaxyrus boreas was the most frequently reported species in the survey (n=271), representing 34% of contributed observations (Table 1). This was followed by observations of *T. granulosa* (n=197), *L. sylvaticus* (n=50), *R. luteiventris* (n=85), *A. macrodactylum* (n=42), and *A. gracile* (n=10). There were also 120 contributed observations of unspecified anurans, 69 observations of unspecified amphibians, and 18 observations of unspecified caudates. In addition, 59 observations pertaining to amphibian populations were made (Table 2), with 64% of these indicating areas where amphibians appear "abundant." Eleven contributed observations indicated areas where amphibians appear to be declining.

2.4.2 Follow-up Surveys.

Twenty-six follow-up surveys were returned representing a 35.6% response rate and adding an additional 30 amphibian observations in the Stikine River region in 2012 (Table 1). Twenty observations were made on the Stikine River and 10 observations were made on Wrangell Island. *Bufo borea*s made up the majority of these observations (43.3%), followed by *T. granulosa* (20%), *L. sylvaticus* (17%), *A. macrodactylum* (7%), and *A. gracile* (3%). No additional observations of *R. luteiventris* were contributed.

2.4.3 Other Methods.

The other methods used in this study to obtain amphibian observations from the public represent 21% of the total observations (Table 1). Subsistence survey observations contributed the most among these methods (10%), followed by in-person observation reports (5%), emailed observations (5%), AHS website observations (1%), and U.S. mail (>1%). Subsistence surveys also resulted in the greatest number of amphibian population observations among these methods (n=20), representing 23% of overall observations in this category.

Interviews with key respondents of the Kiks.adi Clan of the Stikine Tlingit elucidated several previously undocumented accounts of cultural relationships with frogs. No cultural relationships with salamanders were recorded. Culture bearers offered stories describing cultural taboos against injuring frogs or bringing them into captivity, stories regarding the supernatural ability of these animals to affect weather conditions, heal human illness, bring about wealth, and lead humans to safety during dramatic hydrologic events. These traditional stories (sometimes told through songs) are highly respected by contemporary knowledge bearers of the clan. Clan members often refer to themselves as frogs and traditionally recognized few differences between humans and other species, except in form. Recognition of differences appears more pronounced contemporarily. Clan members also commonly receive long-held or recently generated names referencing frogs. The primary author (JTR) was honorarily adopted into the Stikine Kiks.adi clan during a ceremony in 2014 and received a newly created name "Xixchi Toowoo" meaning "frog feelings" or "he who cares for the frogs", referencing both the animals themselves and the members of the clan.

Key respondents frequently mentioned an ability of deceased ancestors to communicate through frogs, especially during periods of economic or emotional hardship. Animals are said to frequently appear near or within respondent homes during these times. Ancestors are also said to continue to communicate with and support living clan member's through cultural items depicting frogs such as hats, masks, rattles, blankets, staffs and other physical objects that have been displayed during ceremonial events. During one such event in November 2015, a frog hat made of wood, copper, and ermine furs was repatriated to the Kaach.adi clan after having been in private collection since 1897. Dancing, singing, and storytelling were used to bring this object "back to life." Frequently, the representations of frogs on traditional objects among the Stikine clans resemble *A. boreas*, a large broad frog with spots (likely representing bumpy or warty skin) and often a distinct white dorsal stripe.

Respect and admiration for frogs appears to apply not only to cultural objects and animals represented in traditional stories and songs, but also to live frogs encountered on local landscapes. Killing or injuring live frogs was considered by some respondents to be akin to killing or injuring a family member. Clan members and other tribal members expressed concern for the conservation of these species locally. Respondents also expressed appreciation for this project's attempt to better understand local amphibian populations, and to help educate the public regarding their roles within local social-ecological systems.

2.5 Discussion

This study resulted in a wealth of amphibian observational data provided by Alaska residents. It also explored the use of several forms of data acquisition to acquire local herpetological knowledge. These data greatly expand available knowledge on amphibian distributions and species diversity in Alaska, and have already been used to help identify long-term monitoring sites for AHS's Stikine Long-term Amphibian Monitoring Program (SLAMP).

Local and traditional knowledge is often underutilized and frequently ignored for non-game species in Alaska. There is sometimes a lack of confidence in species identification by non-experts, especially when photographic evidence is unavailable. We contend, however, that this data is equally valuable and often available at a richer temporal and spatial scale than targeted biological studies. To enhance LHK contributions for a study of this nature in a region with limited amphibian species diversity, educational materials and species guides can provide for relatively accurate identification.

We found that most respondents have the ability to differentiate more generally between frogs, toads, salamanders, and newts. Differentiation between *L. sylvaticus* and *R. luteiventris* and between *T. granulosa* and *A. gracile* was difficult for some respondents, and it is possible that some of these observations were misreported. Importantly, the presence of *A. gracile* on the Stikine River and Wrangell Island has not been confirmed. Many respondents contributing observations of these changed their identification to *T. granulosa* after being contacted with more information, and no photographic evidence was provided to researchers. Unusual or unconfirmed species observations may warrant additional targeted research for confirmation. Furthermore, the resulting data can be categorized at higher taxonomic classifications when confidence in identification is low.

Regardless of questions related to species identification for some contributed records, this study substantially enhanced and expanded available distributional data for both anurans and caudates in Alaska. The data indicates that residents are commonly encountering these species on local landscapes, and retaining knowledge of these encounters that can be later recorded and analyzed. We found that many respondents became even more interested in herpetofauna and more likely to record and submit their observations, as a result of this study. Similarly, Carstensen et al. (2003) reported that their citizen science participants became better informed and better prepared for future amphibian searches. This study also obtained data pertaining to population changes over time, identification of areas with perceived increases in amphibian abundance, and the identification of breeding habitat demonstrated by observations of chorusing and/or the presence of tadpoles. This knowledge can assist researchers and managers in targeting specific wetlands for future population surveys and conservation measures.

This project also provides insights on the utility of several methods of LHK acquisition. A wide variety of methods, such as those presented in this paper, can increase LHK availability. We also contend that increased exposure to information and research promotes increased participation by the public, and more precise reporting of human-amphibian interactions. While the mailed surveys produced the greatest number of records, this method is most costly. Mailed surveys are known for low response rates, and promotional campaigns are sometimes necessary to boost participation. Still, the cost of these surveys is often far less than conducting on-the-ground inventories, and savings can be realized when the resultant information is used to narrow the scope of sampling initiatives.

Furthermore, this project helped to document cultural relationships with amphibians in the Stikine Region, both in terms of encounters with and cognition of these animals, but also indigenous relationships that can be used to inform local conservation, education, and management. The historical and contemporary importance of anurans within Wrangell likely influences the development of local herpetological knowledge and the attitude of residents toward these species. The abundance and relative herpetological diversity of amphibians in the Stikine Region as compared to other regions of Alaska may also influence the development and availability of this knowledge.

Utilizing LHK collection methods such as the ones described in this paper provides opportunities for public education and outreach and allows residents to take an active role in the research and conservation of local species. Promoting community-based conservation is beneficial for sustainable wildlife management, particularly where financial and logistical constraints limit the availability of scientific data. We suggest that utilization of these methods will continue to advance herpetological knowledge in Alaska, and that they should be considered for other species and areas of inquiry.

2.6 Acknowledgments

We offer our sincere appreciation to the communities of Wrangell and Petersburg, the Alaska Department of Fish and Game, the United States Forest Service – Wrangell Ranger District, the Center for Global Change at the University of Alaska Fairbanks and the Alaska Herpetological Society for helping to make this work possible.

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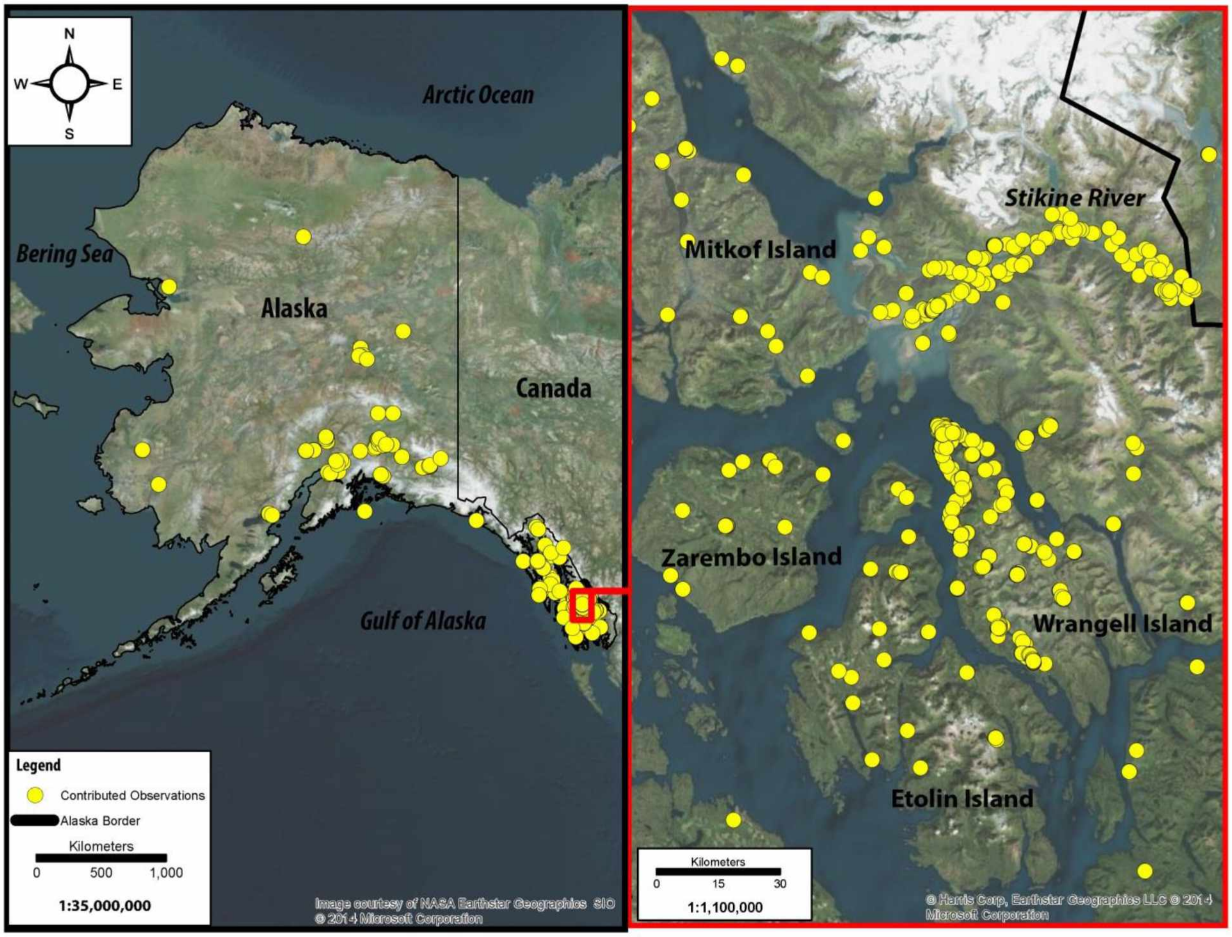

Figure 2.1. General statewide locations of contributed amphibian observations in Alaska, with particular emphasis on the Stikine River region.

Table 2.1. Number of contributed amphibian observations by species and by observation submission method.

Abbreviations represent the following: *Anaxyrus (Bufo) boreas* (ANBO), *Rana luteiventris* (RALU), *Lithobates (Rana) sylvaticus* (LISY), *Pseudacris regilla* (Baird and Girard, 1852; PSRE), *Taricha granulosa* (TAGR), *Ambystoma macrodactylum* (AMMA), *Ambystoma gracile* (AMGR), and *Ambystoma laterale* (AMLA). Amphibia spp., Anura spp. and Caudata spp. represent amphibians that were identified to class or order but not to genus or species. "*" indicates that 11 were of species that contributors did not believe to be depicted in the survey, thus potentially representing introduced or exotic species.

			Taxonomic identification												
		No. unique contributing households	ANBO	RALU	LISY	PSRE	RAAU	TAGR	AMMA	AMGR	AMLA	Amphibia spp.	Anura spp.	Caudata spp.	**TOTAL**
Contribution method	Classroom Survey	12	1	0	0	0	0	0	0	0	0	0	13	0	**14**
	Mailed Survey	190	271	85	50	0	0	197	42	10	0	69*	120	18	**862**
	Follow-up Survey	14	13	0	5	0	0	6	2	1	0	0	2	1	**30**
	AHS Website	10	9	2	0	0	0	4	0	0	1	0	1	0	**17**
	In_Person	21	19	1	13	0	0	8	0	0	0	0	19	2	**62**
	Email	26	26	0	10	1	0	9	2	0	0	0	5	0	**53**
	U.S. Mail	1	0	0	0	0	0	0	1	0	0	0	0	0	**1**
	Sub Surveys	28	15	0	65	0	6	6	1	0	0	0	19	0	**112**
	TOTAL	**-**	**354**	**88**	**143**	**1**	**6**	**230**	**48**	**11**	**1**	**69**	**179**	**21**	**1151**

Table 2.2. Number of contributed amphibian observations pertaining to population status and evidence of breeding activity by submission method. Unique households represent the number of households that contributed observations within each observation type.

		Observation Type							
		Absent	Abundant	Declining	Inclining	**TOTAL**	Chorusing	Tadpoles	**TOTAL**
Contribution method	Unique Households	**4**	**24**	**22**	**3**	**-**	**33**	**30**	**-**
	Classroom Survey	0	0	0	0	**0**	0	0	**0**
	Mailed Survey	8	38	11	2	**59**	20	35	**55**
	Follow-up Survey	0	0	0	0	**0**	2	2	**4**
	AHS Website	0	0	0	0	**0**	0	1	**1**
	In_Person	0	0	6	0	**6**	2	0	**2**
	Email	0	0	1	0	**1**	9	0	**9**
	U.S. Mail	0	0	0	0	**0**	0	0	**0**
	Sub Surveys	0	0	19	1	**20**	20	2	**22**
	TOTAL	**8**	**38**	**37**	**3**	**86**	**53**	**40**	**93**

Table 2.3. Number of contributed observations by location of observation.

Abbreviations represent the following: *Anaxyrus* (*Bufo) boreas* (*ANBO*), *Rana luteiventris* (RALU), *Lithobates* (*Rana) sylvaticus* (*LISY*), *Pseudacris regilla* (PSRE), *Taricha granulosa* (TAGR), *Ambystoma macrodactylum* (AMMA), *Ambystoma gracile* (AMGR), and *Ambystoma laterale* (AMLA). Amphibia spp., Anura spp. and Caudata spp. represent amphibians that were identified to class or order but not to genus or species.

	Species												
Location of contributed observation	**ANBO**	**RALU**	**LISY**	**PSRE**	**RAAU**	**TAGR**	**AMMA**	**AMGR**	**AMLA**	**Amphibia spp.**	**Anura spp.**	**Caudata spp.**	**TOTAL**
Copper River Basin	**0**	**0**	**46**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**46**
Glenn Highway	0	0	11	0	0	0	0	0	0	0	0	0	11
Glennallen (Town)	0	0	1	0	0	0	0	0	0	0	0	0	1
Mendeltna (Town)	0	0	1	0	0	0	0	0	0	0	0	0	1
Tolsona (Town)	0	0	7	0	0	0	0	0	0	0	0	0	7
Unspecified	0	0	2	0	0	0	0	0	0	0	0	0	2
Lake Louise (Town)	0	0	12	0	0	0	0	0	0	0	0	0	12
McCarthy (Town)	0	0	9	0	0	0	0	0	0	0	0	0	9
McCarthy Road (McCarthy Area)	0	0	9	0	0	0	0	0	0	0	0	0	9
McClaren River (Denali Highway)	0	0	1	0	0	0	0	0	0	0	0	0	1
Richardson Highway	0	0	3	0	0	0	0	0	0	0	0	0	3
Kenny Lake	0	0	1	0	0	0	0	0	0	0	0	0	1
Summit Lake (Paxson Area)	0	0	2	0	0	0	0	0	0	0	0	0	2
Wrangell St. Elias National Park	0	0	1	0	0	0	0	0	0	0	0	0	1
Interior	**1**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**7**	**0**	**12**
Anaktuvuk Pass (Town)	0	0	2	0	0	0	0	0	0	0	0	0	2
Central (Town)	1	0	0	0	0	0	0	0	0	0	0	0	1
Fairbanks	0	0	2	0	0	0	0	0	0	0	5	0	7
Badger Road	0	0	1	0	0	0	0	0	0	0	1	0	2
Ballaine Lake	0	0	0	0	0	0	0	0	0	0	1	0	1
Chena Hot Springs Road	0	0	0	0	0	0	0	0	0	0	1	0	1
City	0	0	1	0	0	0	0	0	0	0	2	0	3
North Pole (Town)	0	0	0	0	0	0	0	0	0	0	1	0	1
Olnes Pond (Fox Area)	0	0	0	0	0	0	0	0	0	0	1	0	1
Northwest	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**
Noorvik (Town)	0	0	0	0	0	0	0	0	0	0	1	0	**1**
Prince William Sound	5	0	0	0	0	0	0	0	0	0	1	0	**6**
Montague Island	2	0	0	0	0	0	0	0	0	0	0	0	**2**
Valdez	3	0	0	0	0	0	0	0	0	0	1	0	4
Duck Flats	1	0	0	0	0	0	0	0	0	0	0	0	1
Robe Lake	2	0	0	0	0	0	0	0	0	0	0	0	2
State DOT Swamp	0	0	0	0	0	0	0	0	0	0	1	0	1
Southcentral	**0**	**0**	**35**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**38**
Anchorage	0	0	5	0	0	0	0	0	0	0	0	0	5
Lake Otis Road	0	0	2	0	0	0	0	0	0	0	0	0	2

Table 2.3 continued…

Location of contributed observation	ANBO	RALU	LISY	PSRE	RAAU	TAGR	AMMA	AMGR	AMLA	Amphibia spp.	Anura spp.	Caudata spp.	TOTAL
	Species												
Point Woronzof	0	0	2	0	0	0	0	0	0	0	0	0	2
Sand Lake Area	0	0	1	0	0	0	0	0	0	0	0	0	1
Chase (Town)	0	0	4	0	0	0	0	0	0	0	0	0	4
Chugiak (Town)	0	0	0	0	0	0	0	0	1	0	0	0	1
Eagle River	0	0	1	0	0	0	0	0	0	0	0	0	1
Eklutna (Town)	0	0	0	0	0	0	0	0	0	0	1	0	1
Fish Lakes (Skwentna Area)	0	0	3	0	0	0	0	0	0	0	0	0	3
Hicks Lake (Glacier View Area)	0	0	1	0	0	0	0	0	0	0	0	0	1
Iliamna Lake	0	0	11	0	0	0	0	0	0	0	0	0	11
Pedro Bay	0	0	10	0	0	0	0	0	0	0	0	0	10
Old Iliamna Village (Abandoned)	0	0	1	0	0	0	0	0	0	0	0	0	1
Palmer (City)	0	0	3	0	0	0	0	0	0	0	0	0	3
Skwentna (Town)	0	0	2	0	0	0	0	0	0	0	0	0	2
Talkeetna (Town)	0	0	1	0	0	0	0	0	0	0	0	0	1
Trapper Creek (Town)	0	0	4	0	0	0	0	0	0	0	0	0	4
Wasilla (City)	0	0	0	0	0	0	0	0	0	0	1	0	1
Southeast	**347**	**88**	**58**	**1**	**6**	**230**	**48**	**11**	**0**	**69**	**165**	**21**	**1044**
Admiralty Island	0	0	0	0	0	1	0	0	0	0	8	0	9
Angoon (Town)	0	0	0	0	0	0	0	0	0	0	7	0	7
Hood Bay	0	0	0	0	0	0	0	0	0	0	1	0	1
Whitewater Bay	0	0	0	0	0	1	0	0	0	0	0	0	1
Baranof Island	9	0	0	1	0	0	0	0	0	0	1	0	11
Dorothy Narrows	1	0	0	0	0	0	0	0	0	0	0	0	1
Sitka	8	0	0	1	0	0	0	0	0	0	1	0	10
Bear Mountain	1	0	0	0	0	0	0	0	0	0	0	0	1
Heart Lake Trail	1	0	0	0	0	0	0	0	0	0	0	0	1
Indian Valley Road	0	0	0	1	0	0	0	0	0	0	0	0	1
Swan Lake	6	0	0	0	0	0	0	0	0	0	1	0	7
Chichagof Island	3	0	0	0	6	0	1	0	0	0	5	0	15
Bear Paw Creek	0	0	0	0	2	0	0	0	0	0	0	0	2
Freshwater Bay	0	0	0	0	1	0	0	0	0	0	0	0	1
Game Creek	1	0	0	0	0	0	0	0	0	0	2	0	3
Garteena Creek	0	0	0	0	0	0	1	0	0	0	0	0	1
Hoonah (Town)	1	0	0	0	0	0	0	0	0	0	3	0	4
Kennel Creek	0	0	0	0	1	0	0	0	0	0	0	0	1
Pavlov Creek	1	0	0	0	2	0	0	0	0	0	0	0	3
Douglas Island	1	0	0	0	0	0	0	0	0	0	0	0	1
Eaglecrest Ski Area	1	0	0	0	0	0	0	0	0	0	0	0	1

Table 2.3 continued…

Location of contributed observation	Species												
	ANBO	RALU	LISY	PSRE	RAAU	TAGR	AMMA	AMGR	AMLA	Amphibia spp.	Anura spp.	Caudata spp.	TOTAL
Etolin Island	12	3	1	0	0	12	0	0	0	1	5	0	34
Anita Bay	0	0	1	0	0	0	0	0	0	0	2	0	3
Burnett Lake	0	0	0	0	0	1	0	0	0	0	0	0	1
Logging Roads	0	0	0	0	0	1	0	0	0	0	0	0	1
Marble Point	1	0	0	0	0	0	0	0	0	0	0	0	1
Mosman Inlet	1	0	0	0	0	0	0	0	0	0	0	0	1
Navy Lake	0	0	0	0	0	1	0	0	0	0	0	0	1
Olive Cove	1	1	0	0	0	1	0	0	0	0	0	0	3
Unspecified	9	2	0	0	0	8	0	0	0	1	3	0	23
Kuiu Island	1	0	0	0	0	0	0	0	0	0	0	0	1
Halleck Harbor	1	0	0	0	0	0	0	0	0	0	0	0	1
Kupreanof Island	6	0	0	0	0	1	1	0	0	0	0	0	8
Colp Lake	0	0	0	0	0	1	0	0	0	0	0	0	1
Humbug Point	1	0	0	0	0	0	0	0	0	0	0	0	1
KahSheets Lake	1	0	0	0	0	0	0	0	0	0	0	0	1
Kake	1	0	0	0	0	0	0	0	0	0	0	0	1
Petersburg Creek	1	0	0	0	0	0	0	0	0	0	0	0	1
Totem Bay	1	0	0	0	0	0	0	0	0	0	0	0	1
Unspecified	1	0	0	0	0	0	1	0	0	0	0	0	2
Mainland	24	8	6	0	0	19	1	0	0	6	8	1	73
Aaron Creek	1	0	0	0	0	1	0	0	0	1	0	1	4
Agassiz Peninsula	1	0	0	0	0	0	0	0	0	0	1	0	2
Berg Bay	1	0	1	0	0	0	0	0	0	0	1	0	3
Blake (Back) Channel	2	1	2	0	0	2	1	0	0	0	0	0	8
Bradfield Canal	1	0	0	0	0	2	0	0	0	1	0	0	4
Chilkoot River (Haines Area)	1	0	0	0	0	0	0	0	0	0	0	0	1
Cleveland Peninsula	4	0	0	0	0	3	0	0	0	1	0	0	8
Anan Bay	1	0	0	0	0	0	0	0	0	0	0	0	1
Frosty Bay	1	0	0	0	0	2	0	0	0	0	0	0	3
Meyer's Chuck	1	0	0	0	0	0	0	0	0	1	0	0	2
Reflection Lake	1	0	0	0	0	0	0	0	0	0	0	0	1
Unspecified	0	0	0	0	0	1	0	0	0	0	0	0	1
Haines (Town)	0	0	0	0	0	0	0	0	0	0	3	0	3
Harding River	0	0	0	0	0	1	0	0	0	0	0	0	1
Juneau Area	3	0	0	0	0	1	0	0	0	0	1	0	5
Cowee Creek	1	0	0	0	0	0	0	0	0	0	0	0	1
Dredge Lake	1	0	0	0	0	0	0	0	0	0	1	0	2
Lake Dorothy	0	0	0	0	0	1	0	0	0	0	0	0	1
Taku River	1	0	0	0	0	0	0	0	0	0	0	0	1
LeConte Bay	0	1	0	0	0	0	0	0	0	0	0	0	1
Martin Lake	1	0	0	0	0	0	0	0	0	1	1	0	3
Mill Creek	0	0	0	0	0	1	0	0	0	0	0	0	1

Table 2.3 continued…

	Species												
Location of contributed observation	**ANBO**	**RALU**	**LISY**	**PSRE**	**RAAU**	**TAGR**	**AMMA**	**AMGR**	**AMLA**	**Amphibia spp.**	**Anura spp.**	**Caudata spp.**	**TOTAL**
Thomas Bay	4	0	0	0	0	3	0	0	0	0	0	0	7
Scenery Cove	3	0	0	0	0	3	0	0	0	0	0	0	6
Swan Lake	1	0	0	0	0	0	0	0	0	0	0	0	1
Virginia Lake	5	6	2	0	0	5	0	0	0	2	1	0	21
Yakutat	0	0	1	0	0	0	0	0	0	0	0	0	1
Mitkof Island	5	0	0	0	0	8	1	0	0	0	10	0	24
Baseball Field Muskegs	0	0	0	0	0	1	0	0	0	0	5	0	6
Blind Slough	0	0	0	0	0	0	0	0	0	0	5	0	5
Frederick Point Road	0	0	0	0	0	1	0	0	0	0	0	0	1
Ideal Cove	0	0	0	0	0	1	0	0	0	0	0	0	1
Man-Made Hole	2	0	0	0	0	0	0	0	0	0	0	0	2
Mitkof Highway	2	0	0	0	0	2	0	0	0	0	0	0	4
Ohmer Creek	0	0	0	0	0	1	0	0	0	0	0	0	1
Petersburg (Town)	0	0	0	0	0	1	0	0	0	0	0	0	1
Sand, Hill, Crane Lakes	1	0	0	0	0	0	0	0	0	0	0	0	1
Unspecified	0	0	0	0	0	1	1	0	0	0	0	0	2
Prince of Wales Island	6	1	1	0	0	4	0	0	0	0	2	0	14
Boyd Lake	1	0	0	0	0	0	0	0	0	0	0	0	1
Coffman Cove	1	0	0	0	0	0	0	0	0	0	0	0	1
Edna Bay	0	0	0	0	0	1	0	0	0	0	0	0	1
Harris River	0	0	0	0	0	1	0	0	0	0	0	0	1
Hydaburg (Town)	0	0	0	0	0	0	0	0	0	0	1	0	1
Karta River	1	0	0	0	0	0	0	0	0	0	0	0	1
Klawock (Town)	0	0	0	0	0	0	0	0	0	0	1	0	1
Port Protection	0	0	1	0	0	0	0	0	0	0	0	0	1
Salamander Lake	0	0	0	0	0	1	0	0	0	0	0	0	1
Sutter Lake	0	0	0	0	0	1	0	0	0	0	0	0	1
Unspecified	3	1	0	0	0	0	0	0	0	0	0	0	4
Revillagigedo Island	2	0	0	0	0	0	0	0	0	0	0	0	2
Ketchikan (City)	1	0	0	0	0	0	0	0	0	0	0	0	1
Manzanita Lake	1	0	0	0	0	0	0	0	0	0	0	0	1
Stikine River	121	24	29	0	0	22	13	2	0	29	61	3	304
Andrews Creek	0	0	0	0	0	0	0	0	0	0	1	0	1
Andrews Slough	2	1	2	0	0	1	0	0	0	0	0	0	6
Barnes Lake	4	0	1	0	0	0	1	0	0	1	2	0	9
Border Area	2	1	1	0	0	0	0	0	0	0	0	0	4
Clearwater Creek	1	0	0	0	0	1	1	0	0	0	1	0	4
Cottonwood Islands	2	0	0	0	0	0	0	0	0	1	1	0	4
Farm Island	29	2	4	0	0	5	3	0	0	3	10	1	57
Binkley Slough	14	2	2	0	0	2	2	0	0	1	7	0	30
Knig Slough	1	0	0	0	0	0	0	0	0	0	1	1	3
Unspecified	14	0	2	0	0	3	1	0	0	2	2	0	24

Table 2.3 continued…

Location of contributed observation	Species												
	ANBO	RALU	LISY	PSRE	RAAU	TAGR	AMMA	AMGR	AMLA	Amphibia spp.	Anura spp.	Caudata spp.	TOTAL
Goat Creek	0	0	0	0	0	0	0	0	0	0	1	0	1
Government Creek	1	0	0	0	0	0	0	0	0	0	0	0	1
Great Glacier	1	0	1	0	0	1	1	0	0	0	0	0	4
Guerin Slough	0	0	0	0	0	0	1	0	0	0	0	0	1
Kakwon	3	0	0	0	0	1	1	0	0	0	0	0	5
Ketili River	0	0	1	0	0	0	0	0	0	0	0	0	1
Limb Island	4	0	0	0	0	0	0	1	0	0	0	0	5
Little Dry Island	1	1	0	0	0	0	0	0	0	0	0	0	2
Mallard Slough	1	0	0	0	0	0	0	0	0	0	0	0	1
Mount Flemmer	3	1	1	0	0	0	0	0	0	0	1	0	6
Mount Rynda	0	0	0	0	0	0	0	0	0	0	1	0	1
North Arm	3	0	0	0	0	0	0	0	0	1	4	1	9
Paradise Slough	0	0	0	0	0	2	0	0	0	0	0	0	2
Point Rothsay	1	0	0	0	0	0	0	0	0	0	1	0	2
Red Slough	4	1	1	0	0	1	0	0	0	3	0	0	10
Sergief Island	1	0	0	0	0	0	0	0	0	0	2	0	3
Shakes Hot Springs	22	8	8	0	0	5	0	0	0	7	11	0	61
Shakes Slough	6	0	3	0	0	1	1	0	0	2	6	0	19
Twin Lakes	24	9	6	0	0	4	3	1	0	10	17	1	75
Warm Spring Island	5	0	0	0	0	0	0	0	0	1	0	0	6
Unspecified	1	0	0	0	0	0	1	0	0	0	2	0	4
Vank Island	1	0	0	0	0	0	0	0	0	0	0	0	1
Woronofski Island	0	0	0	0	0	1	0	1	0	0	0	0	2
Wrangell Island	149	51	20	0	0	156	31	8	0	31	59	17	522
Earl West Cove	1	1	0	0	0	0	0	0	0	0	0	0	2
Hermit Creek	0	0	0	0	0	1	0	0	0	0	0	0	1
High Country Trail	0	0	0	0	0	7	0	0	0	1	1	0	9
Highbush Lake	0	0	0	0	0	8	1	0	0	1	1	0	11
Little Thoms Lake	3	1	0	0	0	0	0	0	0	0	0	0	4
Logging Roads	3	1	0	0	0	3	2	0	0	1	1	2	13
Long Lake	4	2	2	0	0	3	1	0	0	2	4	1	19
Lower Thoms Creek	0	0	0	0	0	0	1	0	0	1	0	0	2
Middle Ridge Cabin	2	0	0	0	0	8	1	0	0	0	0	2	13
Muskeg Meadows Golf Course	14	7	4	0	0	8	0	0	0	0	7	1	41
Nemo Point	3	0	1	0	0	1	0	0	0	0	1	0	6
Pats Creek	0	1	0	0	0	1	0	0	0	0	1	0	3
Pats Lake	29	4	2	0	0	9	3	1	0	3	14	3	68
Pats Lake Road	2	0	0	0	0	1	0	0	0	0	0	1	4
Rainbow Falls Trail	1	0	0	0	0	4	1	0	0	0	1	0	7

Table 2.3 continued…

Location of contributed observation	Species												
	ANBO	**RALU**	**LISY**	**PSRE**	**RAAU**	**TAGR**	**AMMA**	**AMGR**	**AMLA**	**Amphibia spp.**	**Anura spp.**	**Caudata spp.**	**TOTAL**
Salamander Creek	6	4	3	0	0	22	8	5	0	1	3	1	53
Lower	4	1	2	0	0	12	6	3	0	0	0	0	28
Upper	1	1	1	0	0	2	2	2	0	1	0	0	10
Unspecified	1	2	0	0	0	8	0	0	0	0	3	1	15
Shoemaker Bay	1	0	0	0	0	1	0	0	0	1	1	0	4
Spur Road	13	5	0	0	0	11	1	0	0	2	3	1	36
Thoms Lake	14	2	1	0	0	4	1	0	0	1	4	0	27
Thoms Place	7	3	0	0	0	3	2	0	0	4	3	1	23
Wrangell (Town)	17	9	4	0	0	18	3	1	0	8	8	3	71
Wrangell Reservoir	2	3	1	0	0	23	1	1	0	1	5	0	37
Zimovia Highway	15	4	2	0	0	10	3	0	0	2	1	1	38
Unspecified	12	4	0	0	0	10	2	0	0	2	0	0	30
Yakobi Island	0	0	0	0	0	0	0	0	0	0	1	0	1
Zarembo Island	7	1	1	0	0	6	0	0	0	2	5	0	22
Baht Harbor	0	0	0	0	0	1	0	0	0	0	0	0	1
Snow Pass Road	2	0	0	0	0	0	0	0	0	0	0	0	2
Unspecified	5	1	1	0	0	5	0	0	0	2	5	0	19
Southwest	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**4**
Bethel (Town)	0	0	0	0	0	0	0	0	0	0	1	0	**1**
Pilot Station (Town)	1	0	0	0	0	0	0	0	0	0	2	0	**3**
TOTAL	**354**	**88**	**143**	**1**	**6**	**230**	**48**	**11**	**1**	**69**	**179**	**21**	**1151**

Chapter 3 Human-Amphibian Interactions in the North: Using a Mailed Survey Instrument to Document Herpetofaunal Relationships [1]

3.1 Abstract

Human-amphibian interactions can be both positive and negative for the species involved. These exchanges can provide recreational and educational opportunities, but they may also result in the introduction of disease and invasive species. Knowledge of the nature and extent of these interactions may provide clues on how to promote responsible ecological practices while preserving important cultural relationships with the natural world. It can also provide valuable insight on Local Herpetological Knowledge (LHK) and its development, including the ability of the public to provide rich observational data on herpetofauna where funding and logistical constraints limit the use of conventional wildlife research methods, as in the case in Alaska. We used a mailed survey in this study to gauge the nature and extent of human-amphibian interactions, and the availability of LHK in the community of Wrangell, Alaska in February of 2012. A total of 280 surveys were returned and respondents provided their household's perceptions and observations of amphibians on local landscapes, descriptions of past encounters, and observations of local climate related changes. We found the mailed survey instrument to be an economic and effective means of documenting this information.

3.2 Introduction

An understanding of shared beliefs, perceived values, and the role of animals within the human experience is vital to successful conservation strategies (Nolan et al., 2006). It is also recognized that as human and animal populations continue to change, it is critical to document human knowledge and emotional orientation toward flora and fauna (Nolan et al., 2006). Emotional responses to animals contribute to the retention and articulation of ethnobiological information (Nolan et al., 2006; Ceriaco, 2012) – information that may be useful to researchers and managers attempting to understand populations for which data is limited, such as for amphibians in Alaska.

Ethnoherpetology is defined as the study of human relationships with and knowledge about amphibians and reptiles. Despite widespread conservation concerns for these species,

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[1] Ream, J.T. and C. Carothers. 2016. Human-Amphibian Interactions in the North: Using a Mailed Survey Instrument to Document Herpetofaunal Relationships. *In-Prep.*

ethnoherpetological studies remain uncommon (Ceriaco, 2012), especially for amphibians. It is known however that human-amphibian relationships vary throughout the world and among cultures. Amphibians have been held in great regard in both traditional and modern societies (Mittermeier et al., 1992) and they have been greatly feared, persecuted, and at times protected (Pough et al., 1998; Ceriaco, 2012).

The development of cultural relationships with amphibians has also occurred in regions inhabited by only a handful of amphibian species. In southeast Alaska, the Tlingit, Haida, and Tsimshian cultural groups each recognize human coexistence with amphibians over time through songs, stories, art and crests, despite the presence of only six native species (McClellan, 1953; de Laguna, 1972; Beck, 1989; Emmons, 1991). There is no historical or contemporary evidence of the consumption of Alaska's native amphibians, therefore these relationships have evolved regardless of economic or gastronomic importance, likely as a result of chance encounters on local landscapes.

In Wrangell, Alaska, three Raven clans of the Stikine Tlingit Indians claim ownership of the frog as a clan crest – the Kiks.adi, Kaach.adi, and Teeyhittan. The traditional relationship with the frog was one of both fear and appreciation as these animals were known to be extremely sensitive to human slights or injuries, but also grateful when shown kindness (de Laguna, 1972). Frog Yeiks (spirits) were considered exceptionally powerful with the ability to heal sickness, convey great wealth, or bring about widespread devastation, qualities that would be appealed to frequently by shamans (Swanton, 1908; McClellan, 1953; de Laguna, 1972; Beck, 1989; Cruikshank, 1992). These traits were also said to be prominent among members of the clans bearing the crest. Post-European assimilation and proselytization have eroded or modified many traditional spiritual beliefs, though contemporary cultural ties to amphibians and respect for these species in Wrangell remain (Ream, unpubl. data). An analysis of this relationship over time will be published in a subsequent manuscript outside of this dissertation.

Cultural relationships with herpetofauna need not necessarily embody spiritual associations or be wholly utilitarian, but may also represent recreational and educational services provided by this taxonomic group in the modern age. Related activities include catching and observing amphibians in the wild, maintaining pet amphibians in the home or classroom, and dissecting amphibians for anatomy and physiology curricula among others. The benefits of utilizing live animals as a formal educational aid has been shown to benefit youth through the development of empathy and other socio-emotional behaviors (Daly and Suggs, 2010; Melson, 2001), and teaching kindness toward animals frequently results in kindness toward people (Arbour et al., 2009). It has also been shown that adults who keep wildlife have increased biological knowledge when compared to those who have never kept wildlife as pets (Drews, 2002).

Still, the collection of wild animals as pets is often illegal, and movement of these species can cause irreparable harm to wild populations. For instance, the chytridiomycosis pathogen that has affected amphibians worldwide has been found to spread through the pet trade, movement of zoo animals, food trade, laboratory animal trade, and unintentional or deliberate release of pets (Daszak et al., 2003). Nonetheless, local knowledge of amphibians may lead to increased awareness of these species on local landscapes.

Human-amphibian interactions may also be passive and strictly observational. These observations and related knowledge, collectively referred to as local herpetological knowledge (LHK), can provide substantial data on amphibian diversity, distribution, abundance and population trends over time (Ream and Carothers, 2016; Ream and Lopez, 2016). These data are valuable when financial and logistical constraints limit the capacity of researchers and managers to conduct conventional herpetofaunal inventories at regular intervals. In addition, local peoples frequently have a greater spatial and temporal depth of local ecological knowledge than do researchers conducting experiments at discrete points in time and space (Nadasdy, 2006).

Accessing and recording local ecological knowledge may be beneficial for the management of several taxonomic groups in Alaska that have received minimal scientific attention and for which population data are extremely limited, such as for amphibians (ADFG, 2006; Ream and Lopez, 2016). Alaska is home to six native species of amphibian and two introduced species (Hodge, 1976; MacDonald and Cook, 2007), and all but the Wood Frog (*Lithobates [Rana] sylvaticus* LeConte) are believed to have northern range extents in southeastern Alaska. Given the vast and sparsely populated nature of the state, relatively little is known about amphibian populations. The acquisition of LHK may provide opportunities to enhance scientific understanding of amphibian populations, but also about the role of human-amphibian interactions in the development of LHK.

There are several means by which LHK has been accessed to date. Nabhan (2003) obtained rich ecological and cultural information on the relationship between Comcaac Native Americans in northern Mexico and reptilian species through intensive interviews and participant observation. In this chapter as well as in chapter two (Ream and Carothers, 2016), we utilized classroom surveys, mailed surveys, and internet forms to collect LHK in Alaska, primarily on local amphibian observations over time.

Mailed surveys provide an opportunity to access local ecological knowledge remotely, and can be more economical than intensive field research. Unfortunately, mailed surveys often have low response rates and this is frequently dependent on the survey topic and length, the targeted audience, and the method of implementation (Bernard, 2006; Dillman, 2000). The use of mailed surveys in herpetological research has been only minimally reported in published literature. Groves and Peterson (1992) reported on a mailed survey that was implemented to better determine the population status and distribution of amphibians in Idaho. The response rate in this study was 25% and respondents provided distributional data for all 15 species native to that state. Groves reported that 301 records of amphibian occurrences were obtained from this survey, including 62 that were potentially new county records, and 88 observations of population trends. This survey did not include questions designed to obtain descriptions of human-amphibian interactions.

Our study used a mailed survey to obtain biological data on amphibians in the Stikine River region of Alaska, and to better understand the nature and extent of human-amphibian interactions among residents of Wrangell, Alaska. The observational data obtained from the study will be described in in a subsequent manuscript. This paper reports on the human-amphibian interactions component of the research, including resident familiarity with and perceptions of amphibians, the handling, translocation and captivity of amphibians, and local observations of climate related changes that may impact amphibians.

3.3 Methods

We used mailed survey instrument to understand human-amphibian interactions among residents of Wrangell, Alaska. This community was chosen because the authors had established rapport with the community through prior research, the nearby Stikine-LeConte Wilderness Area is known to be relatively diverse herpetologically for the state, and it is home to the Stikine

Kiks.adi Clan of the Tlingit Indians that bear the frog as their major crest. In addition, substantial historical and contemporary data on amphibians exists for this region (e.g. Hodge, 1976; Waters, 1992; Norman and Hassler, 1995), and this permits data comparisons and the ability to contribute to the Alaska Herpetological Society's (AHS) Stikine Long-term Amphibian Monitoring Program (SLAMP).

The survey instruments were developed to ascertain two primary components of LHK. The first of these, and this is what we report on here, includes a series of questions pertaining to human-amphibian relationships, perceptions of the importance of amphibians to local ecological and human communities, perceptions of stressors on local amphibian populations and their habitats, and local observations of climate related changes. The second series of questions pertained to specific, locational observations of amphibians on local landscapes over time; these locational records are reported in Chapter 2 (Ream and Carothers, 2016).

A census of community households was attempted in this study. To accomplish this, the survey instrument was mailed to each of 1,296 Post Office (PO) boxes in Wrangell in February of 2012. Postal mail in Wrangell is delivered solely to PO boxes that must be paid for by residents and includes 1,144 PO boxes designated as "residential" and 152 boxes registered as "business" (USPS, 2012). Surveys were sent to both box designations to increase the likelihood of distribution and receipt by all households.

Most questions in the survey targeted all members of the respondent household, although some demographic questions were specific to the respondent. According to the 2010 United States census (USCB, 2015), there were 2,369 residents and 1,053 occupied households in Wrangell that year. The Alaska Department of Labor and Workforce Development (ADLWD, 2015) also publishes annual population estimates in years that do not have a federal census, but these do not include an estimate of occupied households. The 2012 population estimate for Wrangell was 2,445. Assuming the ratio of occupied households to residents was equivalent in 2010, we estimated 1,087 occupied households in Wrangell in 2012.

Survey implementation followed several key components of the Dillman Tailored Design Survey Method (Dillman, 2000) to maximize response rate. This included the use of introductory post cards mailed two weeks in advance of the survey, self-addressed stamped envelopes for survey return, and reminder post-cards sent two weeks following the survey mailing. It also included a $1 monetary incentive with each survey, pastel green cover letters with original signatures in blue ink, a color photograph on the first page, personalized return address labels, and first-class postage. Respondents also had the option of completing the survey online. Survey completion was promoted with radio announcements, a local newspaper article, billboard flyers, and targeted Facebook advertisements.

A photographic guide to Alaska's native amphibians was included in the survey as a reference for the respondent to help mitigate varying degrees of species identification abilities. We also expanded the use of the word "frogs" to "frogs and toads" and the use of the word "salamanders" to "newts and salamanders" in many of the questions to assist individuals that may not be familiar with the similarities and differences between these species and groups.

3.4 Results

A total of 280 surveys were completed and returned, resulting in a response rate of 21.6% (n=1296). This represents approximately 25% of estimated households in Wrangell (1,087). An additional 11 correspondence items were returned without the survey and some completed surveys were returned with notes, literature, photographs or other materials. Data pertaining to human-amphibian interactions is reported here and locational observations (including 862 records from 190 households) is reported in Chapter 2 (Ream and Carothers, 2016).

3.4.1 Demography and Access

All questions were not answered by all respondents. Of those respondents filling out the survey and answering demographic questions, 56% were female (n=145), and 44% were male (n=115). Only 13% of respondents (n=34) self- identified as Alaska Native[2]. Seventy-eight percent (n=203) of respondents indicated that they were born and raised outside of Wrangell, while 19% (n=58) indicated that they were born and raised in the community. The mean age of survey respondents was 52 (n=239) and the mean total duration of respondent residency in Wrangell was 27 years (n=238). Most respondents indicated that they live in or near Wrangell year-round (96%, n=253), and 4% (n=10) indicated that they do not live in the community year-round.

[2] The 2010 U.S. census reported approximately 16% of the population identifying as "American Indian and Alaska Native alone," and 25% identifying as American Indian or Alaska Native alone or in combination with one or more races (USCB, 2015).

Survey respondents were asked about the frequency with which their household members have travelled on local landscapes other than Wrangell Island over time, and about their access to modes of marine transportation. Among respondent households that provided a response (n=266) 69% indicated that they travel frequently or occasionally on local landscapes other than Wrangell Island, while 31% indicated that they rarely or never travel on local landscapes other than Wrangell Island. Sixty-seven percent (n=177) of households indicated that they have regular access to a boat, and 33% indicated that they do not.

3.4.2 Amphibian Familiarity and Importance

Respondents were asked about their household's perceived familiarity with local amphibians, as well as with the laws pertaining to these species. Of households answering this question (n=270), most (53%) indicated that they are unfamiliar with local amphibians. Approximately 41% indicated that they are somewhat familiar and only 6% indicated that they are very familiar (Figure 1). Regarding perceived familiarity with laws pertaining to amphibians, a majority of households (76%) answering the question (n=270) indicated that they are very unfamiliar with laws pertaining to amphibians, followed by 16% indicating they are somewhat unfamiliar, 6% somewhat familiar, and 3% very familiar (Figure 1).

Survey respondents were asked about their household's perceptions of amphibians as important components of the local ecological community as well as to local human groups. The majority of households (91%; n=264) indicated that they view amphibians as important components of the local ecological community, while 9% indicated that they do not view them as important to the local ecological community. The respondents were asked to circle all human groups to which amphibians are important with options including everyone, adults, children, teachers, Alaska Natives, Non-Natives, and no one. All but one household answered this question and only 4% (12 responses) indicated that they are not important to any human groups, with the remaining 95% (267 responses) marking that amphibians are important to at least one human group. A majority of households (81%; 226 responses) indicated that amphibians are important to "everyone," followed by those indicating they are important to children (6%; 18 responses), to teachers (4%; 10 responses), to Alaska Natives (3%; 7 responses), and to adults (2%; 6 responses). No household indicated that amphibians are important to only non-natives.

To gauge respondent sentiment toward amphibians, the survey included a question that asked about the household's general attitude when amphibians are encountered on local landscapes. Respondents were able to choose one or more options from a list that included enjoyment, excitement, fear, respect, and indifference. Most households (83%) answering this question (n=274) chose only one option and some chose multiple options (15%). Enjoyment was the most frequently selected response both alone (41% of responses; n=297) and in combination with other responses (13% of responses). This was followed by households who marked excitement (25%), respect (23%), indifference (9%), and fear (2%). None of the Alaska Native households (n=34) chose fear or indifference, and within this demographic group, 17 households indicated that they feel enjoyment, 14 households indicated that they feel respect, and 11 households indicated that they feel excitement.

3.4.3 Amphibian Encounters

Respondents were asked about the frequency with which household members have seen "frogs and toads" and "newts and salamanders" on local landscapes during their lifetimes, as well as about changes in the frequency of these observations over time. For frogs and toads, 22% of households answering the question (n=275) indicated that they frequently encounter these species (5 or more times per year), 35% indicated that they encounter them occasionally (1-4 times per year), 31% rarely (multiple years between sightings), and 13% never (Figure 2). Regarding changes in frequency, 59% of households providing a response (n=260) indicated that they encounter the same amount of frogs and toads now as they have in the past, 33% indicated that they encounter fewer now as in the past, and 8% indicated that the encounter more now than in the past (Figure 3).

For newts and salamanders, only 8% of households answering the question (n=272) indicated that they frequently encounter these species, 26% indicated that they encounter them occasionally, and 39% rarely (Figure 2). Regarding changes in frequency, 65% of households answering the question (n=239) indicated that they encounter the same amount of newts and salamanders now as they have in the past, 31% indicated that they encounter fewer now as in the past, and 4% indicated that they encounter more now than in the past (Figure 3).

For those households that indicated that they see more or fewer amphibians now as in the past, they were also asked to choose from a list of reasons for this, or to add their own. The predominant perceived reasons for indicating “more” frogs and toads now as in the past included that the populations seem to be increasing (8 responses), that they are paying more attention (7 responses), that they are traveling more frequently on local landscapes (4 responses). For those indicating that they see “fewer” frogs and toads now as in the past, the predominant perceived reasons for this included that they travel less frequently on local landscapes (41 responses), that the frog and toad populations are decreasing (39 responses), and that they are paying less attention (9 responses).

For newts and salamanders, the predominant perceived reasons for seeing “more” now as compared to the past included paying more attention (4 responses), traveling more frequently (2 responses), newt and salamander populations seem to be increasing (2 responses), and that they are paying less attention (2 responses). For those indicating that they see “fewer” newts and salamanders as in the past, the predominant perceived reasons for this included traveling less frequently on local landscapes (41 responses), newt and salamander populations seem to be decreasing (39 responses), and that they are paying less attention (9 responses).

Respondents were asked if members of their household have encountered each of the native amphibian species thought to be present on local landscapes and pictured within the survey. Boreal Toads (*Anaxyrus [Bufo] boreas* Baird and Girard) were observed most frequently (162 responses), followed by Rough-skinned Newts (*Taricha granulosa* Skilton; 130 responses), Columbia Spotted Frogs (*Rana luteiventris* Thompson; 69 responses), Long-toed Salamanders (*Ambystoma macrodactylum* Baird; 41 responses), Wood Frogs (*Lithobates [Rana] sylvaticus;* 30 responses), and the Northwestern Salamander (*Ambystoma gracile* Baird; 16 responses; Figure 4).

The survey also includes a question that attempts to gauge how often amphibian encounters were opportunistic or intentional. Respondents were asked if members of their household ever looked specifically for local amphibians, and they were able to choose one or more options including frogs, toads, newts, salamanders, or “no, we haven’t looked for them.” All but five households answered this question. Among valid responses (n=275) a majority of households (59%) indicated that they have not actively looked for amphibians. Of those households indicating that they actively looked for amphibians (n=112), most have searched for a combination of frogs, toads, newts, or salamanders (73%) with fewer searching for just one of these species groups

(27%) or for all of these species groups (29%). Toads were searched for most often by respondent households (101 responses), followed by frogs (83 responses), salamanders (64 responses), and newts (47 responses).

3.4.4 Amphibian Handling, Translocation, and Captivity

Respondents were asked how often members of their household handle amphibians when they are encountered on local landscapes. The most common answer to this question among responses (n=273) was never, with 40% of households selecting this option. This was followed by seldom (32%), occasionally (23%), and always (5%). In total, 60% of households indicated that they or a member of their household had handled amphibians encountered on local landscapes.

The survey asked respondents if members of their household have ever moved wild amphibians from one area to another, either intentionally or unintentionally. Seventy-nine percent of households offering valid responses (n=273) indicated that they have never moved wild amphibians from one area to another, and 21% indicated that they had. The survey also asked how often respondent household members think that humans in the region move amphibians from one place to another and 266 valid responses were given. “Rarely” was the response chosen most often (47%) followed by occasionally (36%), never (14%) and frequently (3%).

Respondents were asked if members of their household ever brought a local wild amphibian home as a pet or to view temporarily in captivity and 276 valid responses were received. Of those, 22% indicated that they had at some point done so in the past. Specifically, respondents were also asked if members of their household have ever brought home local wild tadpoles to observe metamorphosis, and 276 valid responses were received. Most respondents (87%) indicated that they had not and 13% indicated that they had.

To understand the fate of wild amphibians brought into the home, respondents that indicated they had brought an amphibian home were asked to choose from a list of possible scenarios. Eighty-six households answered this question and among those, “released into the wild where it was originally captured” was the most common response (35%). This was followed by “released into the wild at a site other than where it was originally captured” (32%), “escaped into the wild near our home” (17%), “eventually died” (14%), and least frequently, “given away” (2%). Ten households chose multiple fate scenarios and two respondents chose three fate scenarios, presumably referencing the fate of multiple amphibians over time.

Respondents were asked if a member of their household ever bought, won, or has been given a non-native amphibian while living in or near Wrangell; 270 valid responses were received. A majority of households (82%) indicated that they had not acquired an amphibian by these means and 18% indicated that they had. Households that indicated that they had bought, won or been given a non-native amphibian (n=49) were also asked where the animals were obtained, when was this most recent time this occurred, and the ultimate fate of these animals. “Local vendor” was chosen most frequently as the source of these amphibians (56% of responses; n=57), followed by “vendor in Alaska” (23%), “friend” (16%), and “vendor outside of Alaska” (5%). No household indicated receiving amphibians from an online vendor. Four households chose multiple sources of amphibians.

Regarding the timing of the most recent non-native amphibian bought, won, or given to members of respondent households, 53% of households (n=49) indicated that this occurred more than five years ago, 24% of households indicated that this occurred one to five years ago, and 22% of households indicated that this occurred less than a year ago. Regarding the fate of non-native amphibians that were bought, won or given to members of respondent households, 88% of households indicated that the amphibians eventually died (n=42), 7% of households indicated that the amphibians were released into the wild (each provided a description of the location), and 5% indicated that the amphibians escaped into the wild.

3.4.5 Climate Change Observations

Human-amphibian interactions may be influenced by climactic changes that effect human access to local environs as well as the distribution and abundance of amphibians on local landscapes. In turn, observations of climactic change may provide insight on amphibian responses to environmental perturbations. Respondents were asked to choose from a list of scenarios pertaining to changes in summer temperatures, winter temperatures, pond volume, and timing of ice-melt along the Stikine River and in proximity to its associated coastal islands in recent years. Respondents also had the option of choosing none of the options and writing additional observations that were not listed.

A total of 65 households chose none of the listed options and did not write in an additional observation. The majority of respondent households (215) chose one or more of the options, or wrote in an additional observation (Table 1). Warmer winter temperatures received the greatest percentage of responses (26%; n=337) from the list of available climate observations in this survey. This was followed by "cooler summer temperatures" (22%), "earlier ice break-ups" (14%), "warmer summer temperatures" (11%), "drying of ponds" (8%), "cooler winter temperatures" (7%), "growing of ponds (more water)" (7%), and "later ice break-ups" (5%). Seventy-one households wrote additional comments for this question. Among those, 34% indicated that there have been no changes or long-term trends, 25% indicted that they are unsure or that their duration in Wrangell has been too short to answer, and 16% indicated that they have observed increased precipitation and/or flooding. The remaining 25% listed a variety of observations including the presence of new and/or invasive plants, insects, and shellfish, stronger winds, fewer berries, decline in medicinal plants, and warmer water temperatures.

3.5 Discussion

This survey was successful in obtaining rich information on human-amphibian interactions in Wrangell, Alaska, as well as in documenting the nature and extent of local herpetological knowledge (LHK) among participating residents. In addition to the data obtained, the study also provided insights on the benefits and challenges associated with the use of a mailed survey instrument.

Importantly, we recognize the likelihood of a response bias to this research. Households with an interest in amphibians, a cultural connection to these animals, with kids, or with adults employed in scientific careers may have been more likely to respond than those with little interest in or connection to the subject matter. With this in mind, some households did return surveys despite having indicated that they do not perceive amphibians as important to local social and/or ecological communities. We do not suggest that these results be extrapolated to the community at large.

3.5.1 Human-Amphibian Interactions

Animals are known to evoke a wide range of powerful emotions derived from experiences and enculturation (Baker, 2001; Nolan et al., 2006). This study found that most respondent households in Wrangell have positive responses to encountering amphibians (enjoyment, excitement, or respect) on local landscapes and that they consider these species important to both the local ecological community (91% of households) and to local human groups (95% of households). In fact, most households (81%) indicated that amphibians are important to all human groups. This suggests that amphibians are to some degree culturally important to the community.

We also found that almost half (47%) of respondent households consider themselves at least somewhat familiar with local amphibians, but that only 9% of households consider themselves at least somewhat familiar with laws pertaining to these species. Though familiarity is a subjective term, this may at least suggest respondent awareness of amphibians and related laws. In Alaska, few state laws apply specifically to amphibians since they are defined by statute as "fish" as per AS 16.05.940 (ALRC, 2015):

> (12) "fish" means any species of aquatic finfish, invertebrate, or amphibian, in any stage of its life cycle, found in or introduced into the state, and includes any part of such aquatic finfish, invertebrate, or amphibian

The state does however require a Fish Resource Permit (FRP) for the collection of wild amphibians for scientific or educational purposes, and it also prohibits the release of live fish, including amphibians, into state waters or onto state lands. Our study suggests that Wrangell residents were largely unaware of amphibian collection and release prohibitions at the time of the survey.

Many residents of Wrangell appear to encounter amphibians on local landscapes regularly. We found that 57% of respondent households encounter frogs and toads at least one time each year but that only 34% of respondent households encounter newts and salamanders at least one time annually. This is reasonable since the species of newts and salamanders in Alaska tend to be more cryptic than frogs and toads, and only *T. granulosa* has been verified on Wrangell Island.

For both "frogs and toads" and "newts and salamanders," most households indicated that they have not observed any differences in the frequency with which they encounter these amphibians over time. Still, a substantial number of households indicated that they encounter less now than they have in the past. While the most frequently reported reason for this in relation to both anurans and caudates is because they travel less on local landscapes, thus having less opportunity to observe amphibians, the second most frequently reported reason was a perceived decline in the populations of these species. Thirty-nine household reported perceived declines for both groups. It is important to note that these are “perceived” declines and may not represent actual declines. These perceptions may have been the result of the seasonality of site visits (e.g. during or outside of the breeding season), visits during different weather scenarios, or visits with various life stages present, among others. That said, multiple households reporting perceived declines at a given site may warrant additional investigation.

We have relatively high confidence in species identifications to at least the genus level, and usually to species. These are likely highly accurate for *Anaxyrus boreas* and *Ambystoma macrodactylum* given their distinct phenotypic characteristics on the dorsum. Distinctions between the two Ranids, *Rana luteiventris* and *Lithobates sylvaticus*, are less apparent to the untrained eye that is viewing only the dorsal surface of the animal. Some respondents also confused *Ambsystoma gracile* and *Taricha granulosa*, though relatively few observations of the former were made and all respondents that could be subsequently contacted later changed their identification to *T. granulosa*.

The frequency of amphibian observations over time by species correlates with known diversity and suspected relative abundance. *Anaxyrus boreas* and *T. granulosa* are common on Wrangell Island (Ream and Lopez, 2016) and were observed most often. *Rana luteiventris* is present on Wrangell Island, but is less common and only recently verified (Ream and Carothers, 2016). This species, along with *Ambystoma macrodactylum* is more common along the Stikine River proper and in closer proximity to its delta. Interestingly, some households indicated that they have seen *A. macrodactylum* and *A. gracile* on Wrangell Island (Ream and Carothers, 2016), but neither species has been verified on the island. We believe that *A. macrodactylum* is relatively easy to identify and may be present but unconfirmed on Wrangell Island. Follow-up conversations with households reporting *A. gracile* observations have primarily resulted in households changing their identification to *T. granulosa* after being given additional information and photographs. Despite a reported egg mass of *A. gracile* on the Stikine River in 1991 (Waters, 1992), the species has not otherwise been confirmed for the region.

Most households indicated that they have not actively looked for amphibians, suggesting that their encounters with these species were opportunistic. Nonetheless, 41% of respondent households indicated that they have or do actively search for amphibians. While the survey did not address the reasons for these active searches, subsequent conversations with area residents suggests that this is done as a recreational activity, particularly among youth that will often “collect” and eventually release “buckets of toads.” Some residents also reported that they and others drive the roads on warm rainy nights to observe toads on the roadway.

A large proportion of respondent households indicated that they had handled wild amphibians, moved wild amphibians from place to place, and/or brought a wild amphibian home as a pet or to view in aquaria. The removal of wild amphibians for pets or as educational aids is concerning because of its potential damage to the breeding population, the threat of disease transmission if animals are re-released into the wild, and anthropogenic modification of population genetics. For these reasons, we were interested in the ultimate fate of amphibians removed from the wild. Unfortunately, among households responding to this question (n=86), most (84%) indicated that the amphibians were either returned to the wild or that they had escaped from the home.

The translocation of native amphibians is not unique to Wrangell. The authors have documented intentional translocation of anuran larvae from several other regions of the state (Ream, unpublished data). In October of 2015 two residents of Chenega Bay, a village on Evans Island in Prince William Sound, explained that 23 years ago they had intentionally transported and released tadpoles from the community of Tatitlek. These were presumably *Anaxyrus boreas* tadpoles that were released in a small pond near Chenega Bay. There are no known native populations of frogs on Evans Island, and the informants explained that “while some people find these animals disgusting, we thought it would be great to have them around.” Though the tadpoles were said to have survived for many months, no viable population was established. This is but one of many similar stories that have been documented in Alaska.

Perhaps of more concern than the movement of wild amphibians on local landscapes is the release of non-native amphibians as these may be invasive and may have greater potential to introduce disease acquired outside of the region. Only 18% of respondents indicated that a member of their household has bought, won, or been given a non-native amphibian and the most commonly reported source of these was a “local vendor.” Follow up conversations with community members suggests that the most common local source is from a 4th of July celebration game booth operated by a local church. Tadpoles (described as very large) are distributed at this event annually. The species that is given away is currently unknown.

While the most commonly reported fate of the non-native amphibians was captive mortality, three households indicated that they released them into the wild and two households indicated that the amphibians escaped into the wild. Even this small number of release / escape events may be alarming, especially if they are occurring with the same frequency throughout Alaska. Intentional releases have already led to the establishment of the non-native *Rana aurora* on Chichagof Island (Hodge, 2004; Pauly et al., 2008) and of *Pseudacris regilla* on Revillagigedo Island (Doogan, 2015). The frequent release of pet Red-eared Slider Turtles (*Trachemys scripta elegans*) has also become a concern for southcentral Alaska (Ream, unpublished data). Public education may be the key to preventing amphibian movements and release; we propose that many residents are simply unaware of the ecological consequences.

Though few questions in this survey were specifically designed to address habitats and climate change, we do feel that the reported observations are important. Many households indicated warmer winter temperatures, cooler summer temperatures, and earlier ice break-ups in recent years. Those households that selected these observations from the survey also had a longer mean duration of residency in Wrangell (29-32 years; Table 1). A smaller number of households reportedly observed cooler winter temperatures and later ice break-ups, but the mean duration of residency for these individuals was only 19 years. This suggests that duration of residency may affect the temporal frame from which recent observations are being compared. Individual observations written by respondents were also particularly interesting, especially those pertaining to invasive species and changes in plant availability. All of these observations, if confirmed, are likely to affect amphibian populations and thus warrant additional research.

3.5.2 Mailed Survey Instrument Methodology

We found the mailed survey instrument to be a useful method for documenting resident perceptions of and interactions with amphibians and their habitats. Despite an acceptable response rate for a mailed survey, we also identified key challenges in its implementation and suggestions for improvement in future research. First, the construction of the survey and promoting its completion were time and labor intensive. It is probable that our response rate is correlated to the intensity of these efforts, as well as with the extent of previously established relationships between the authors and the community. Researchers lacking previously established community relationships and providing limited survey promotion activities or contact attempts may observe lower response rates.

Providing all Wrangell households with a survey was another challenge in this study. While the number of "residential" designated PO boxes in Wrangell was 1,144, this does not necessarily represent the number of households because some households may have multiple boxes and some households may not have a box. To account for households that did not receive a mailed survey, advertised links to a web-based survey were provided. This was the closest approximation to a census that was available for a mailed survey.

This survey was 10 pages in length and included 48 questions, many of which consisted of multiple parts. Bernard (2006) advises that surveys be 10 pages or less and 125 questions or less, as beyond this, response rate has been shown to decline (Dillman, 1978). Though we did not exceed this maximum page and question count, we do believe that survey length can be a deterrent to respondents and likely affected our response rate. The survey topic is also likely to introduce bias in the sample.

A major drawback of mailed surveys as compared to in-person surveys is the relative inability of the researcher to follow-up with individual respondents. We found that some households failed to provide responses for all questions in the survey. It was also nearly impossible to provide additional instructions to households that may have been confused about a question. Where responses were unusual, incomplete, or particularly interesting, there was limited opportunity to seek additional information from the household, especially when the household did not respond with contact information or if they left their post office box number question blank.

Using a mailed survey instrument allowed us to gauge the frequency and nature of human-amphibian interactions in Wrangell, as well as local perceptions of these species. While the method allows this data to be collected from a distance, it severely limits the researcher's ability to provide additional context to the resultant data. In-person interviews, targeted surveys, public forums, and citizen science programs may be used to gain additional insight on these topics.

This study was successful in gauging the nature and extent of the average degree of local herpetological knowledge among many residents of Wrangell, Alaska, including the perceived importance of amphibians within social-ecological systems. Preliminary information gleaned from these survey results suggest that respondents observe and interact with amphibians, that local observations may be useful for understanding amphibian populations, and that many residents have generally positive attitudes toward the role that amphibians play in social-ecological systems. Despite an apparent lack of direct subsistence or economic value, many Wrangell residents perceive amphibians as providing important ecosystem and cultural services within their community.

3.6 Acknowledgments

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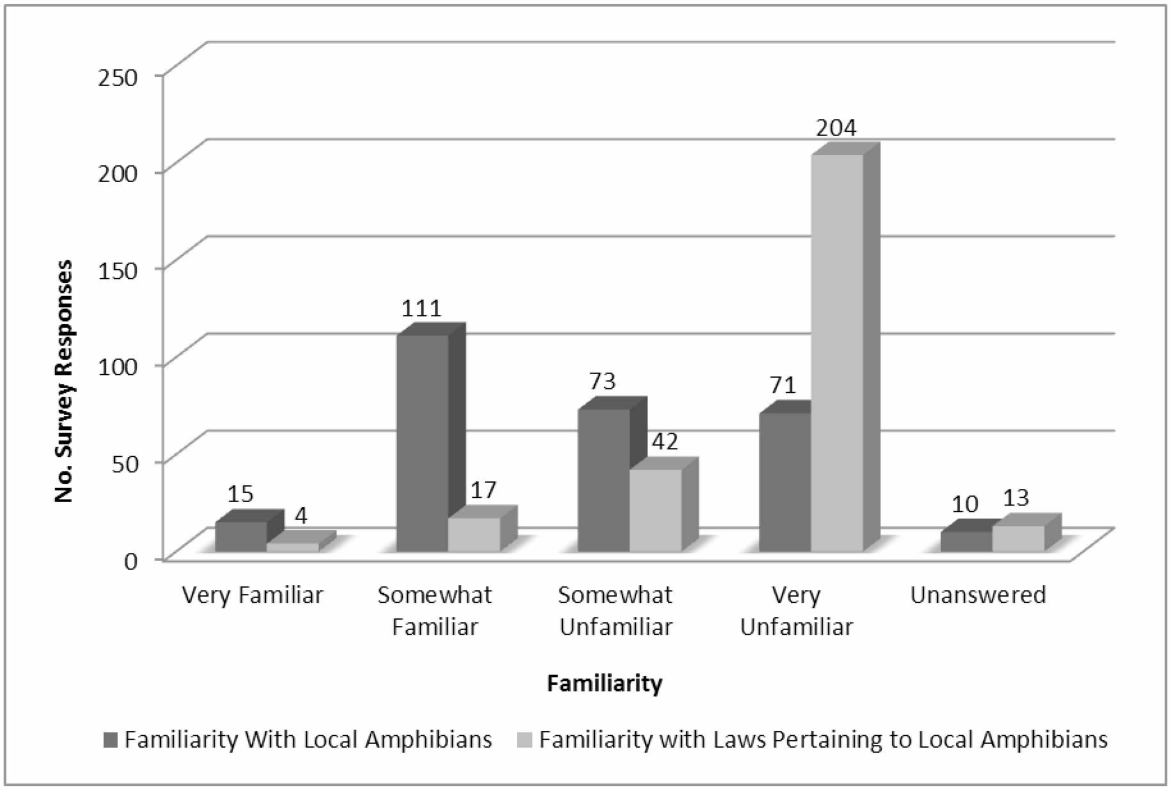

Figure 3.1. Respondent household perception of personal familiarity with local amphibians in Wrangell, Alaska in 2012.

Question instructions noted that “for all questions we are referring to amphibians occurring in the general region of Wrangell and the Stikine River, including associated islands.”

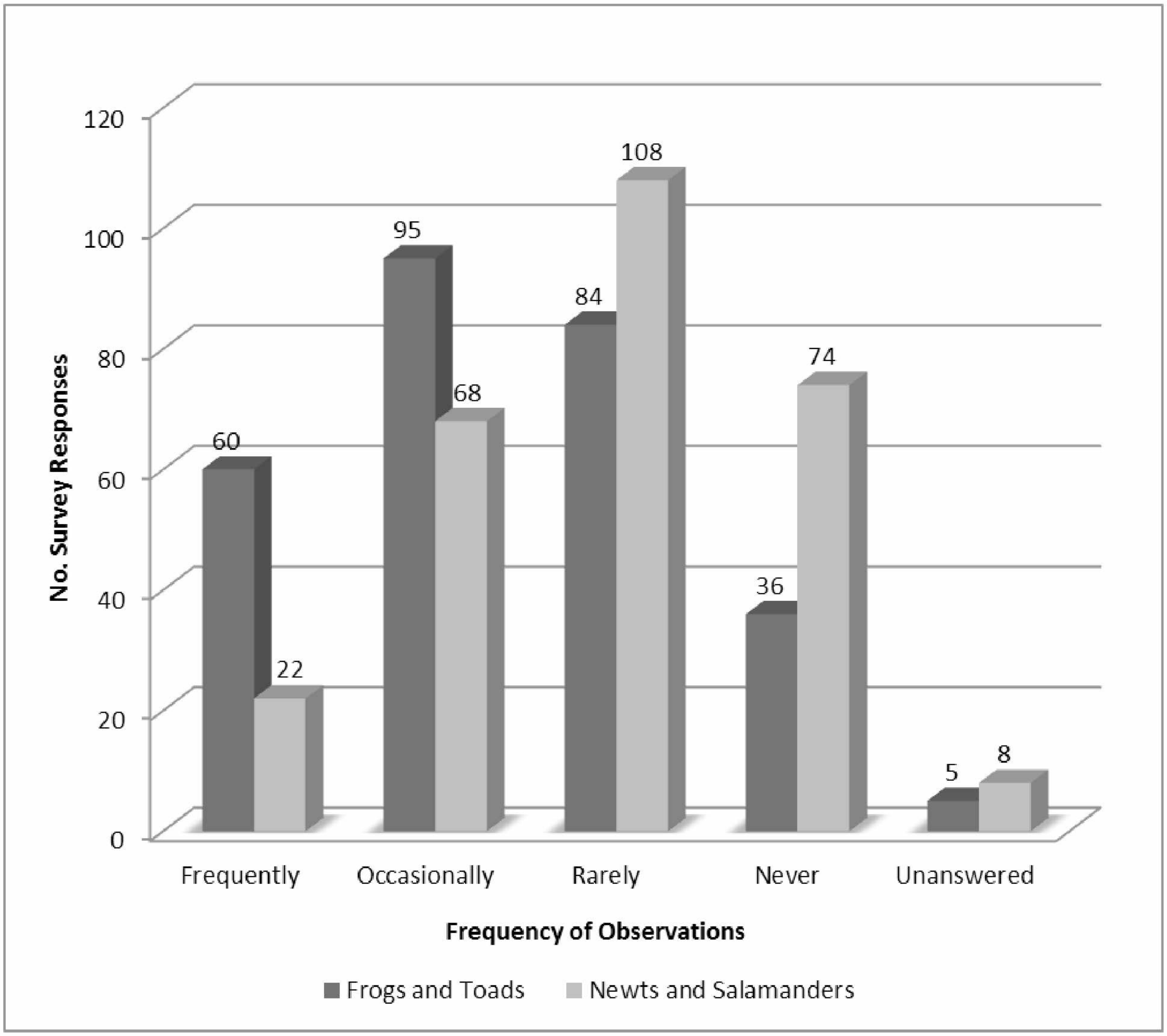

Figure 3.2. Reported frequency of local amphibian sightings during respondent lifetimes.

Question instructions noted that "for all questions we are referring to amphibians occurring in the general region of Wrangell and the Stikine River, including associated islands." Frequently was describes as 5 or more times annually, occasionally as 1-4 times annually, and rarely as multiple years between sightings.

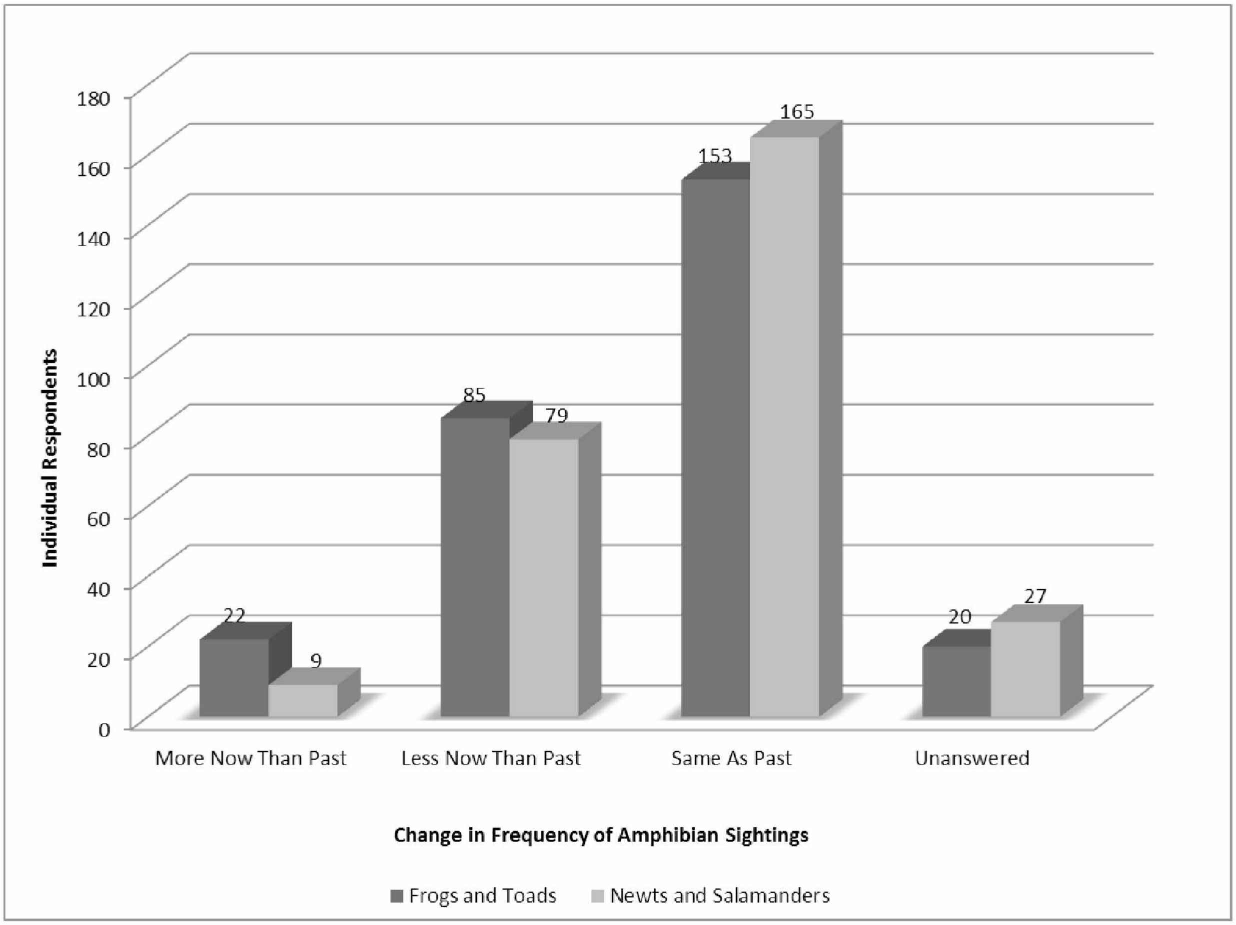

Figure 3.3. Reported change in frequency of local amphibian sightings during respondent lifetimes.

Question instructions noted that "for all questions we are referring to amphibians occurring in the general region of Wrangell and the Stikine River, including associated islands."

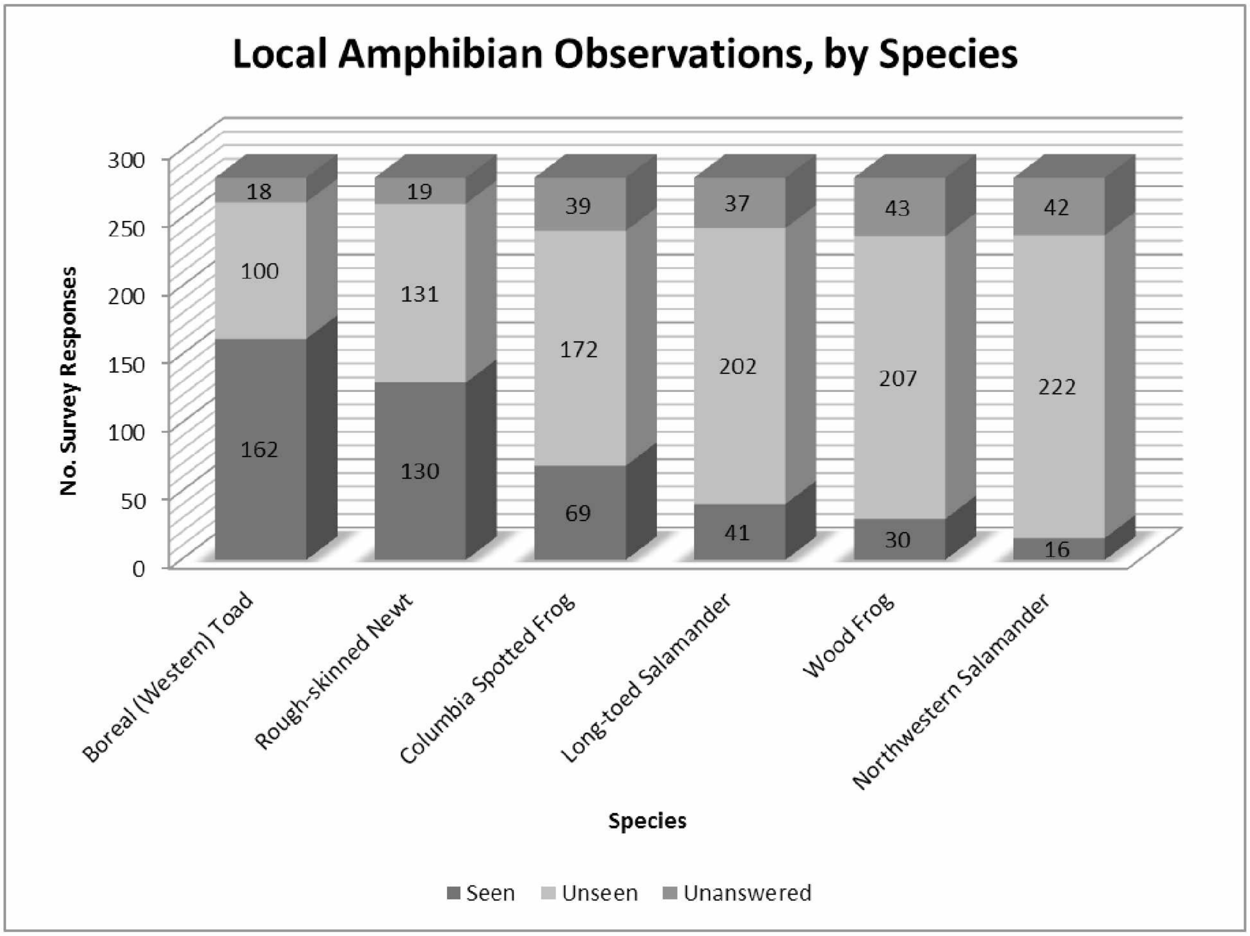

Figure 3.4. Respondent household observations of amphibians on local landscapes, by species.

Question instructions noted that "for all questions we are referring to amphibians occurring in the general region of Wrangell and the Stikine River, including associated islands."

Table 3. 1. Respondent household observations of local environmental change "along the Stikine River and its associated coastal islands in recent years," by mean respondent duration in Wrangell and mean respondent age.

Change Type	No. Respondents	No. Respondents Providing Duration Information	Mean Respondent Duration in Wrangell (Years)	No. Respondents Providing Age Information	Mean Respondent Age (Years)
Later Ice Break-ups	18	15	19	15	49
Growing of Ponds (More Water)	23	19	30	21	53
Cooler Winter Temperatures	25	25	19	25	52
Drying of Ponds	26	20	28	21	55
Warmer Summer Temperatures	36	26	31	28	54
Earlier Ice Break-ups	47	39	32	42	52
Cooler Summer Temperatures	73	66	30	67	52
Warmer Winter Temperatures	89	70	29	74	52
Other	71	67	24	64	55

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Chapter 4 Monitoring Herpetofauna in a Northern Wilderness: Results of Active Herpetological Sampling and Citizen Science on Alaska's Stikine River[1]

4.1 Abstract

In 2014, the Alaska Herpetological Society (AHS) established the Stikine Long-term Amphibian Monitoring Program (SLAMP) to monitor populations and provide baseline data for management programs. Five long-term monitoring sites were established on the Stikine River; in this paper we report on the results of five sampling events, including a two year citizen science initiative at Twin Lakes and Chief Shakes Hot Springs. A total of 1,321 individuals of three species (*Anaxyrus boreas*, *Rana luteiventris* and *Taricha granulosa*) were observed during these inventories, in addition to many thousands of tadpoles of *A. boreas* at Twin Lakes. Breeding activity was documented for *A. boreas* at both study sites. No ambystomatid salamanders, snakes, or *Lithobates sylvaticus* were observed.

4.2 Introduction

Six species of amphibians occur natively in the temperate rainforests of southeast Alaska (Hodge 1976, MacDonald and Cook 2007), but relatively little is known regarding their distribution, abundance, and population dynamics through time (Anderson 2004, ADFG 2006). These species include the Western Toad (*Anaxyrus boreas* Baird and Girard), Wood Frog (*Lithobates sylvaticus* LeConte), Columbia Spotted Frog (*Rana luteiventris* Thompson), Rough-skinned Newt (*Taricha granulosa* Skilton), Long-toed Salamander (*Ambystoma macrodactylum* Baird), and the Northwestern Salamander (*Ambystoma gracile* Baird). Only *L. sylvaticus* is widely distributed in other regions of the state (Hodge 1976, Macdonald and Cook 2007).

Information on the distribution and status of amphibian populations in Alaska is largely due to financial and logistical constraints. The state is vast (1.2 million km^2) and sparsely populated (710,231 individuals in 2010; USCB 2010) with a limited transportation infrastructure. These challenges coupled with a lack of dedicated funding and research personnel (Olson 2009) have generated data gaps, particularly for those species that are not commonly consumed by humans.

[1] Ream JT, Perry S, Lopez JA. 2016. Monitoring Herpetofauna in a Northern Wilderness: Results of Active Herpetological Sampling and Citizen Science on Alaska's Stikine River. *In-prep.*

For these reasons, alternative means of data acquisition may be helpful and necessary for instituting management and conservation programs (Ream and Carothers 2016).

Among popular alternative sources of biological data are citizen science programs that enlist interested members of the public as volunteer scientists (Conrad and Hilchey 2011). These programs can record previously acquired local knowledge and observations, but also train participants to collect data alongside of institutional researchers. In the last century, large scale citizen science programs have helped to address the distribution and abundance of organisms across space and time (Dickinson, Zuckerberg and Bonter 2010). Citizen science has also been useful in promoting a reconnection between people and nature, but also between people and science (Devictor, Whittaker, and Beltrame 2010).

The Alaska Herpetological Society (AHS) established the Stikine Long-term Amphibian Monitoring Program (SLAMP) in 2014, using the results of previous studies as baseline data for the initiative to assist managers in better understanding Alaska's amphibian populations (e.g. Hodge 1976, Waters 1992, Norman and Hassler 1995, Ream and Lopez 2016). The program integrates active sampling, local knowledge and citizen science to acquire population data on amphibians in the Stikine River region of Alaska where all six native amphibian species are thought to occur (although the occurrence of *Ambystoma gracile* has not been verified). SLAMP also attempted to document the presence of a snake (*Thamnophis*) reported but not verified from the region. Here we report the implementation of and results of a two year active sampling program, as well as a citizen science initiative entitled "Camp'Phibian."

4.3 Methods

4.3.1 Study Sites

The SLAMP initiative targets the Stikine River because of the availability of historic data for this region, local amphibian species diversity, and limited human impact resulting from federal wilderness regulations in the Stikine-LeConte Wilderness. Two of the five sites identified for long-term monitoring were chosen for this study, Twin Lakes (also called Figure Eight Lakes) and Chief Shakes Hot Springs.

4.3.1.1 Twin Lakes Site

This site was selected because 1) all six native Alaska amphibians are thought to occur here 2) it is relatively easy to access 3) it is extensive in area compared to other sites and 4) the nature of the site makes it relatively safe for young volunteer surveyors. The SLAMP survey framework includes 17 transects along the margins of this wetland (Figure 1), and these were used in the present study. The site consists of two interconnected lakes encompassing approximately 110 ha. The estimated shoreline length is 2,567 m for the western lake 3,775 m for the eastern lake.

Twin Lakes is a popular summer recreational destination on the Alaska portion of the Stikine River, primarily for residents of the nearby communities of Wrangell and Petersburg. While the site receives more human visitation compared to many other sites in the Stikine-LeConte Wilderness, visitation is relatively minimal because of its remote location. The lakes consist of two extensive yet shallow wetlands (rarely exceeding 1 m in depth), formed in spring by rising water levels in the Stikine River that cause their source spring to flood the meadows through which the spring outflow reaches the river. The lakes begin to fill when the Stikine River reaches approximately 5.2-5.5 m as measured by the U.S. Geological Survey (USGS) gauging station on the lower Stikine River.

The depth and extent of the lakes fluctuate greatly throughout the year, usually draining and flooding the lakes several times per year. During the summer months and especially on warm days, the shallow water of this site makes it a popular recreation area. Water temperature may be one factor that attracts amphibians to the site despite minimal cover and patchy aquatic vegetation along the lake margins.

The lakes are flanked to the north by a large mountain that rises steeply several hundred meters from the edge of the lake. The base of the mountain shows geothermal activity as evidenced by several small warm-springs occurring along its southern base. A series of inlets and small channels occur along the northern edge of the lakes, and steep banks are common. Grasses and sedges are dominant along the lake edge for approximately 100 m or less. The vegetation gradually transitions to stands of Alder (*Alnus* spp.) and Willow (*Salix* spp.), followed farther from the lakes by old-growth forest consisting primarily of Sitka Spruce (*Picea sitchensis* [Bong. & Carr.]) and Hemlock (*Tsuga* spp.). Western Skunk Cabbage (*Lysichiton americanus* Hulten & H. St. John) is also common in the undergrowth of forested areas.

On the southern edge of the lakes the slope of the banks is more gradual and a thick alder-willow forest begins relatively close to shore. Old-growth forest is patchy in this area, except in the eastern and western areas. A strip of land approximately 0.2 km wide separates the southern edge of the lakes from the Stikine River (Figure 1). The main river can be accessed by following the lake outlet from the western lake approximately 3.0 km through a winding channel. A public-use cabin is located between the eastern lake and the Stikine River.

4.3.1.2 Chief Shakes Hot Springs Site

Chief Shakes Hot Springs is much smaller than Twin Lakes (ca. 2.5 ha; Figure 2) but is considered a productive amphibian breeding habitat for several species (Ream and Lopez 2016). This is a popular recreation area visited primarily by residents of Wrangell and Petersburg. The U.S. Forest Service maintains several site facilities, including a boat dock, boardwalk, outhouse, changing rooms, and two wooden hot tubs. The site is located near the mouth of a small hot spring at the base of an unnamed mountain. The spring flows past the manmade structures and through a meadow where it combines with colder water sources and forms Warm Springs Slough. This meadow comprises the majority of the site and includes three SLAMP transects (Figure 2).

Vegetation at this site is comprised largely of grasses, sedges, and sphagnum moss. The meadow is bordered by an alder and willow forest that eventually gives rise to old growth comprised primarily of spruce and hemlock. Four small streams combine with the main hot spring channel within the meadow. Meadow water levels fluctuate with water levels in the Stikine River. When Stikine River levels reach approximately 6.1-6.4 m at the USGS gauging station, the meadow begins to flood and tributary channel margins become indistinguishable. During periods of extremely high water, the meadow becomes a lake where boats can sail past the dock to the lower hot tub.

4.3.2 Sampling

4.3.2.1 Semi-Annual SLAMP Inventories

SLAMP amphibian inventories are conducted by AHS volunteers as time and funding permit. During this study, an inventory was conducted in the spring of 2014 that included both Twin Lakes and Chief Shakes Hot Springs (Table 1). At Twin Lakes, 17 transects were established around the perimeter of the lakes based on historical amphibian observations and shore access (Figure 1). We conducted visual encounter (VE) and auditory surveys in transects 1 through 9 on 20 May 2014 and transects 10 through 17 on 21 May 2014. At Chief Shakes Hot Springs, three transects (Figure 2) were established and VE and auditory surveys were conducted on 19 May 2014.

We used dipnets opportunistically to sample aquatic areas along transects with high vegetation or high turbidity where visual surveying was unlikely to detect amphibians. Unbaited minnow traps also were used opportunistically near transects where salamanders were captured previously by this means. Traps were set overnight and processed in the morning at Twin Lakes. Minnow traps were deployed for 4 h at Chief Shakes Hots Springs before they were checked and removed. All amphibians observed along each transect were recorded. Site characteristics, morphological measurements and photographic vouchers were recorded for 1-2 individuals of each species and life stage encountered in a transect.

Water levels were moderately high during sampling, resulting in increased water surface area and decreased land exposure at both sites (Table 1). Movement between transects and opportunistic sampling thus occurred by rowing and/or driving a jet boat at Twin Lakes. River levels resulted in minimal flooding at Chief Shakes Hot Springs during sampling, with only minimal flooding of transect boundaries.

4.3.2.2 Camp'Phibian Surveys

Twin Lakes was surveyed in the first and second years of the Camp'Phibian program (Table 1). Chief Shakes Hot Springs was added as an inventory site in year two. This site was visited during a 3 h period on 24 May 2014. Ten individuals including 5 adults and 5 youth participated in the program in year one; nine individuals including 5 adults and 4 youth participated in the program in year two.

In year one, amphibian inventories of all Twin Lakes transects on the eastern lake (transects 1-9) occurred on 6 June 2014; all transects on the western lake (transects 10-17) on 7 June 2014. In year two, transects 1-9 were inventoried on 23 May 2015; transects 10-14 on 24 May 2015; transects 15-17 on the morning of 25 May 2015. All three transects at Chief Shakes Hot Springs were inventoried on 24 May 2015.

Sampling consisted of VE and auditory surveys nearly identical to those used in the semi-annual surveys. Participants formed a line at regular intervals from one another across transects, and walked the extent of each transect to visually scan the area from the forest edge to the near-shore aquatic habitat. A second sweep was sometimes necessary to cover the entire extent of the larger transects. Dipnets and minnow traps also were used opportunistically in the same manner as in the semi-annual inventories. Participants walking in proximity to the water's edge used their dipnets every 4.5-6.1 m to sample for submerged amphibians. When an amphibian was sighted by a participant, nearby participants were informed to avoid double counting. Tally clickers were used to keep track of *Anaxyrus boreas* observations within each transect. When an amphibian was captured, group members convened to assist in processing the animal. Processing involved documenting site characteristics and obtaining morphological measurements and photographic documentation for the individual. Photographs and associated data were recorded using the Environmental Systems Research Institute (ESRI) Collector application on an Apple iPad. A maximum of two individuals of each species and life stage were processed within each transect. Minnow traps were used opportunistically at the Twin Lakes site. In 2014, unbaited minnow traps were deployed in transects 2 and 13. In 2015, minnow traps were deployed overnight in transects 2, 3, 4, 5, 12, 13, and 17. Three traps in transect 13 were baited with a can of sardines packed in soy oil. This bait was suggested by another researcher as a possible means of attracting *A. gracile*, a species that was previously reported on this transect (Waters 1992) but which remains unverified. Traps were placed near the source of a warm spring flowing into the lower lake along the edge of the transect.

At Twin Lakes, a systematic inventory of all transects on the eastern lake (transects 1-9) occurred on 23 May 2015; transects 10-14 were sampled on the western lake on 24 May 2015 and transects 15-17 were sampled on the western lake on 25 May 2015. Sampling methods were nearly identical to those used in year one, except that fewer animals were processed along each transect. An amphibian inventory of the Chief Shakes Hot Springs site also was conducted during a 3 h visit to that location. Given the small size of this site, all three transects were thoroughly inventoried (Figure 2). VE, auditory surveying and dipnetting were used.

During the first year of Camp'Phibian, water levels were moderately high at Twin Lakes (Table 1) with many transects requiring chest waders or canoes for access. In year two, water levels were higher and canoes were necessary for transport between most transects. At Chief Shakes Hot Springs in year two, water levels were moderately high, with large portions of each transect submerged in less than 0.5 m of water. This caused tributary streams of different temperatures to merge into larger pools with indistinct margins within transects.

4.4 Results

A total of 1,321 individual amphibian observations were made during this study (859 observations from the semi-annual SLAMP inventories and 462 observations made during Camp'Phibian events; Table 2). This number includes 375 observations at Twin Lakes over the course of three sampling events, and 946 amphibians at Chief Shakes Hot Springs over the course of two sampling events (Table 3). At Twin Lakes, more amphibian observations were made in the eastern lake (n=225), than in the western lake (n=150).

Only three amphibian species were observed- *Anaxyrus boreas*, *T. granulosa*, and *R. luteiventris;* no *L. sylvaticus*, *A. macrodactylum*, or *Ambystoma gracile* were detected, nor was the snake *Thamnophis*. *Lithobates sylvaticus* has not been found at Twin Lakes since 1972-1973 (Hode 1976; Table 4). Breeding of *Anaxyrus boreas* was documented at both study sites.

Anaxyrus boreas frequently was observed at both sites, with a total of 1,263 individual observations (Table 2), including a sighting of more than 100,000 *A. boreas* tadpoles along transects 15-17 in the western lake at the Twin Lakes site in June of 2014. Tadpoles were recorded as a single observation (Table 2) with a range of Gosner Stages (21-23; Gosner 1960) between 21 and 33, based on an examination of 10 individuals. The number of tadpoles was estimated by counting the number in a 1m X 1m square and then extrapolating to the approximate number of squares with tadpoles. Our observations of breeding activity for *A. boreas* and *T. granulosa* at Twin Lakes are consistent with Waters' 1991 interpretation of breeding phenology at this site (Waters 1992).

Tadpoles of *A. boreas* also were observed at Chief Shakes Hot Springs in both years. Tadpoles were most abundant in the main hot springs channel (transect 2) in 2014, and were found exclusively there in 2015 (Table 2). In 2014, smaller numbers of tadpoles were found in an adjacent warm-water stream channel on the northern edge of transect 1. The 2014 tadpoles had a greater range of Gosner Stages (26-45) compared to 2015 tadpoles (stages 32-35). In both years, the channels also contained several post-spawn lamprey carcasses of unknown species.

Taricha granulosa was the second most commonly observed species at Twin Lakes (n=11; Table 2); *R. luteiventris* was the second most commonly observed species at Chief Shakes Hot Springs (n=27; Table 2). All *T. granulosa* observations were captured in minnow traps (Table 3). Most *R. luteiventris* observations were at Chief Shakes Hot Springs (n=27; Table 3); those at Twin Lakes (n=4) were exclusively from the northeastern quadrant of the eastern lake. Several previous studies have observed breeding activity for *R. luteiventris* at Twin Lakes (Table 4), but we did not.

Tadpoles of *Anaxyrus boreas* represented the greatest number of individual observations for any life stage (n=808), followed by subadults (n=411) and adults (n=44; Table 2). Most subadult *A. boreas* were found in May of 2015 (n=396) at both Twin Lakes (n=310) and at Chief Shakes Hot Springs (n=86). Other observed life stages included *R. luteiventris* subadults (n=18), *R. luteiventris* adults, (n=13), and *T. granulosa* adults (n=27); only *T. granulosa* were gravid. No other tadpoles and no egg masses were observed.

4.5 Discussion

Conducting amphibian inventories in 2014 and 2015 provided an opportunity to observe differences in species richness and life stages between months and between years at two study sites known to provide amphibian breeding habitat. The results lend insight to spring emergence, breeding phenology, winter survival, and other life history characteristics for the species observed. Further, our results add information to the Stikine Long-term Amphibian Monitoring Program (SLAMP) initiative. However, a key constraint of these results is the highly variable sampling effort which limits our interpretations to largely qualitative assessments.

4.5.1 Species Accounts

Amphibian populations at both study sites appear to be stable from year to year considering information available since 2012 (see also Ream and Perry 2016, Ream and Lopez 2016). There were differences and correlations in our findings compared to previous studies. Waters (1992) reported breeding activity of *Anaxyrus boreas*, *R. luteiventris* and *Ambystoma gracile* at Twin

Lakes in 1991 (Table 4). Whereas we did not observe breeding activity, it is possible that egg masses were present but not observed or that *R. luteiventris* bred at Twin Lakes earlier in the spring prior to our arrival, with tadpoles remaining undetected. Waters (1992) suggested that this species bred at Stikine River sites in April of 1991. In chapter six we report an observation of an egg mass of this species at Twin Lakes on 22 May 2013.

The abundance of juvenile *Anaxyrus boreas* at Twin Lakes in 2015 was surprising and had not been reported here previously in the spring. Many Wrangell residents mentioned observing late summer and early fall emergence. Most juvenile amphibians were presumed to have hatched and emerged in 2014 and to have experienced high rates of winter survival. This is likely due to favorable summer conditions followed by a mild fall and winter with limited snowfall and relatively warm temperatures. Similar spring abundance of juvenile toads was observed at Chief Shakes Hot Springs (Ream and Lopez 2016) where milder conditions are present year-round.

Several amphibian species appear to use the habitats in the immediate vicinity of Chief Shakes Hot Springs. This area provides mild climatic conditions and winter shelter for these species. A Wrangell resident provided photographic evidence of *A. boreas* tadpoles at the site in early February of 2015 when the surrounding landscape was covered in snow and most adjacent water bodies were frozen.

Warm springs are utilized by *T. granulosa* along the Stikine River. This includes a site within 1 km of the western lake at Twin Lakes that was found to be important newt breeding habitat (Ream and Lopez 2016). At Chief Shakes Hot Springs, this species was observed only when captured in minnow traps. Four hours of trapping resulted in 16 newt captures in 2014. The duration of this trapping period was short since overnight camping is not permitted and there was not an opportunity to return in the morning. In addition, this site receives substantial human visitation and there are limited areas to deploy traps where they are likely to remain undetected and undisturbed. It is probable that newts were present in May of 2015 but were undetected. Adults seem to prefer water temperatures that are slightly cooler than those present in the main channel at Chief Shakes Hot Springs.

Rana luteiventris adults and subadults also occurred at the hot springs site, but only Norman and Hassler (1995) suggested it as breeding habitat for this species. They documented metamorph emergence in mid to late summer. The species is very fast and difficult to capture, a behavior that may have led to many individuals being undetected. This was also true at Twin Lakes where several frogs could not be captured for verification.

Anaxyrus boreas consistently has been the most frequently encountered species at both study sites. Twin Lakes provides important breeding habitat as evidenced by the observation of more than 100,000 tadpoles. Natural resource managers should pay particular attention to developments that could modify the habitat in this area or increase human traffic.

At Chief Shakes Hot Springs, *A. boreas* tadpoles were observed primarily in the warmest bodies of water, although subadults were observed throughout transects. In both years, observers likely counted only a fraction of tadpoles given the abundance of vegetative cover at this site. Subadults were common in both years, especially within 1 m of transect channels. Most subadults observed in 2015 likely metamorphosed earlier in the same year. Only two adult toads were observed at this site, suggesting that adults disperse following winter and early spring breeding.

It remains unclear if three species (*Ambystoma macrodactylum*, *A. gracile* and *L. sylvaticus*) occur at Twin Lakes. *Ambystoma macrodactylum* and *L. sylvaticus* were reported in 1972 and 1973 respectively (Hodge 1976), but no sightings have been reported since (Waters 1992, Norman and Hassler 1995). *Ambystoma macrodactylum* has not been observed at Twin Lakes since an individual was reported on 4 August 1972 (Hodge 1973, Norman 2004; Table 4). Waters (1992) and Norman and Hassler (2004) suggested that this species may have been extirpated from the area. Project duration and sampling limitations have not fully resolved these discrepancies.

According to several accounts of local residents, *A. macrodactylum* has been seen in the lakes since 2010. We reported a single individual from a beaver pond system approximately 0.7 km to the east of Twin Lakes (Ream and Lopez 2016). The historical records, anecdotal observations, and ongoing survey efforts indicate low numbers and/or ephemeral populations of this species in the area.

An egg mass of *A. gracile* was reported at Twin Lakes in 1991 (Waters 1992), but the validity of this record remains unconfirmed. No previous or subsequent surveys have reported *A. gracile* elsewhere in the American or Canadian portion of the Stikine River drainage (Waters 1992, Norman and Hassler 1995, Slough 2013, Ream and Lopez 2016). The lack of confirmation on the presence of *A. gracile* suggests that 1) the 1991 egg mass observation was in error, 2) the species is present but has not been encountered 3) the species seemingly occurs in very low abundance, or 4) the species has been extirpated from the area. Active searching and the use of both baited and unbaited traps failed to result in an observation of this species. Given the continued absence of a valid species voucher despite intensive sampling, as well as habitat characteristics that appear suboptimal for a species requiring extended larval periods (i.e. shallow depth of water and lack of cover; Sprules 1974, Hoffman, Larson and Brokes 2003), it seems likely that this species is not present in the Twin Lakes area and possibly along the entire Stikine River corridor. The application of environmental DNA detection techniques may be useful in further elucidating the occurrence of these enigmatic species at Stikine River sites.

Lithobates sylvaticus was not observed during this study. We did observe two individuals of this species in 2013 (Ream and Lopez 2016), both on the southern edge of transect 3 near the boat dock at Chief Shakes Hot Springs. In this area, the influence of the hot spring on water temperature is greatly diminished. This species may inhabit warm or hot springs as regularly as the other species, perhaps due to biological mechanisms allowing its persistence in colder climates, including throughout most of Alaska (Hodge 1976, MacDonald and Cook 2007, Larson and others 2014). *Lithobates sylvaticus* has not been reported at Twin Lakes since August 1973 (Hodge 1976). While there appears to be suitable habitat and the species has been reported as occurring sympatric with *R. luteiventris* elsewhere on the lower Stikine River (Ream and Lopez 2016), intensive sampling has not resulted in a subsequent observation at Twin Lakes. Norman and Hassler (1995) reported observations of newly transformed *L. sylvaticus* at Chief Shakes Hot Springs in mid to late summer.

This project focused primarily on amphibians because sea turtles are the only reptiles known to naturally occur in Alaska (Hodge 1976, Hodge and Wing 2000). There have been several reported sightings of Garter Snakes (*Thamnophis* spp.) from the Stikine and Taku Rivers in southeast Alaska (Foley 1976, Hodge 1976), but no valid museum records or photographs exists. An ecologist with the National Park Service reportedly observed Garter Snakes in the late 1970s and later wrote (Lewis Sharman pers. com. 2009):

> "Incidentally, I hope there's no doubt in anyone's mind that *Thamnophis* does in fact occur in the Stikine drainage. It's surprising to me that no vouchers exist, but the snakes definitely do - I remember them clearly from when I worked for the USFS out of Petersburg in 1978 and 1979. Certainly [these were] not uncommon at the time"

Sharman later wrote (Lewis Sharman pers. com. 2013):

> "I think it was at (or near) the Chief Shakes Hot Springs bath house. It was 1978 or 1979, in the summer. The weather was warm and dry. We saw them in thick grass right along the riverbank, or perhaps the bank of a slough. I don't recall any context regarding flooding one-way or the other. I remember seeing several individuals (up to a half dozen?) within several lineal meters of bankside. Once we saw the first one, we spent a few minutes actively looking for them over the course of a half hour or so."

No other reports of Garter Snakes in the Stikine River drainage have been reported. Several biologists have searched opportunistically for snakes in the region (Waters 1992, Norman and Hassler 1995) but no evidence of snake occurrence has been documented.

4.6.2 Amphibian Bioblitz Program

All Camp'Phibian participants in both years of the program appeared genuinely excited for the opportunity to participate in this hands-on learning experience that allowed youth to contribute valuable information to answer ongoing research questions. Participants were exposed to a variety of educational resources and were trained in herpetological methods and wilderness skills. Each participant contributed many hours assisting with the inventory of the Twin Lakes and Chief Shakes Hot Springs sites.

Camp'Phibian allowed a very large site to be thoroughly sampled in a short amount of time. The area covered and the percentage of land scanned was far greater than any previous sampling effort at Twin Lakes. Still, working with volunteers and youth presented several challenges that should be considered when developing and implementing citizen science initiatives for herpetological work in a northern wilderness. First, it is important to consider the impact that environmental conditions will have on participants. For instance, the first full day of sampling in year one was marked by relatively warm conditions and an abundance of mosquitos. These conditions caused rapid fatigue and a decline in morale that carried into the second day of sampling. Transects 15, 16, and 17 were completed by a single observer (JTR) due to youth participant fatigue.

To encourage continued participation, the spatial extent of day two sampling was reduced (transects 15-17 were sampled by JTR). Participants were prepared for the insect conditions at the site, but problems occurred as a result of the duration of exposure. A smaller spatial scale of sampling or a longer period to complete the work would likely improve morale and limit fatigue, especially for younger participants. During periods of continuous movement, insect activity was limited. For this reason, participants seemed eager to count and identify species rather than to collect voucher photographs and morphological measurements. Considering exposure of participants to insects is important, and this was listed most often by year one participants as the single greatest challenge of the experience.

In year two many of the above listed strategies were implemented. This included limited processing of amphibians, longer breaks, more time to complete transects, and visits to other sites on the river. Youth also were engaged in other educational activities, including crafts and experiments. Diversifying project activities throughout the day appeared to be an effective means of decreasing fatigue and increasing motivation. Insect activity was also minimal compared to year one, and this was considered by most participants to have enhanced the experience in year two.

Three of the five youth participants from year one were retained in year two, and these were joined by a new youth participant in the second year. According to the Girl Scout troop leader, the two participants from year one that were unable to attend in year two had scheduling conflicts and this was not related to their willingness or desire to return to the program. Retained participants expressed content with program modifications.

In conclusion, we found that using citizen science volunteers to collect data on amphibians in the north was valuable and should be considered by other programs. We suggest that these programs limit the spatial scale of sampling to maintain motivation and morale. Emphasis should be placed on active sampling, and activities should be diverse. Data collection that requires frequent sedentary pauses should be limited, especially when insects are expected to cause significant participant discomfort.

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4.7 Acknowledgements

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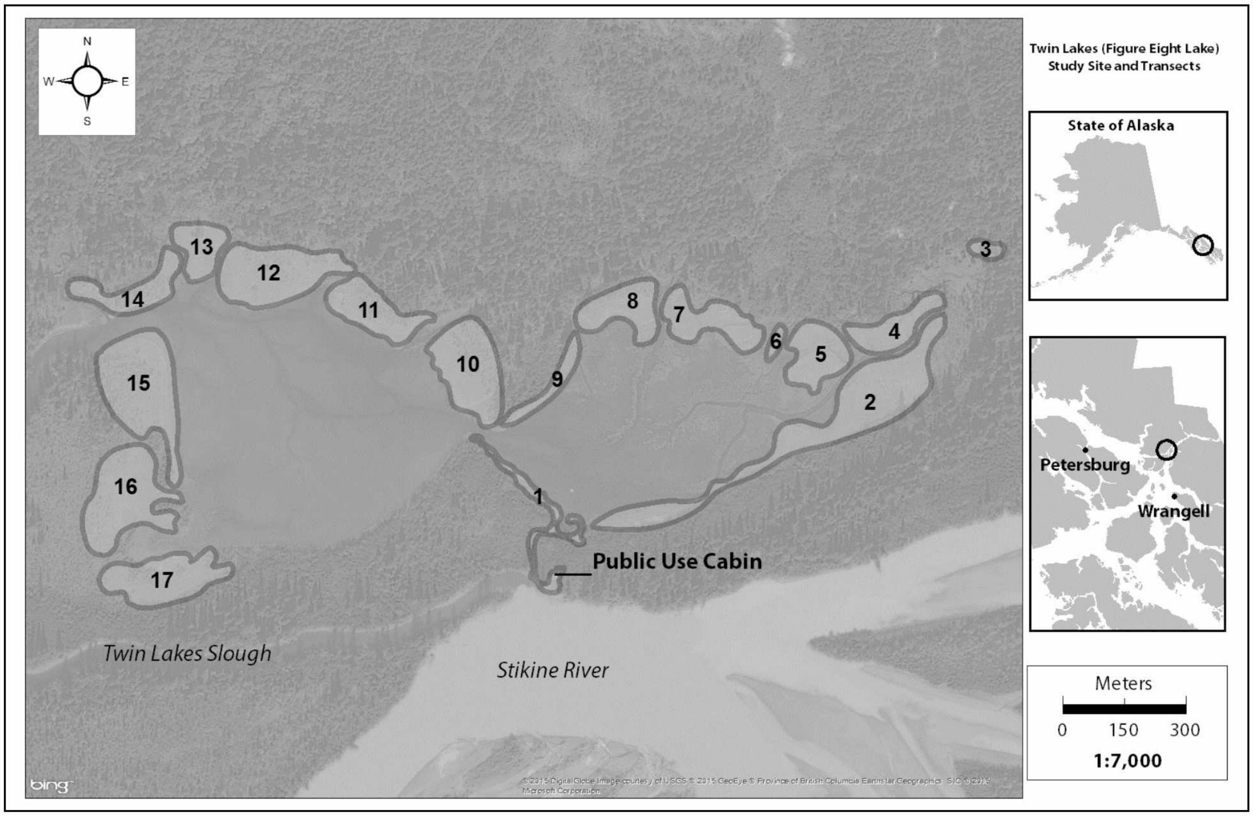

Figure 4.1. Twin Lakes (also called Figure Eight Lake) study site and transects map.

Twin Lakes is one of five long-term monitoring sites established by the Alaska Herpetological Society for its Stikine Long-term Amphibian Monitoring Program (SLAMP).

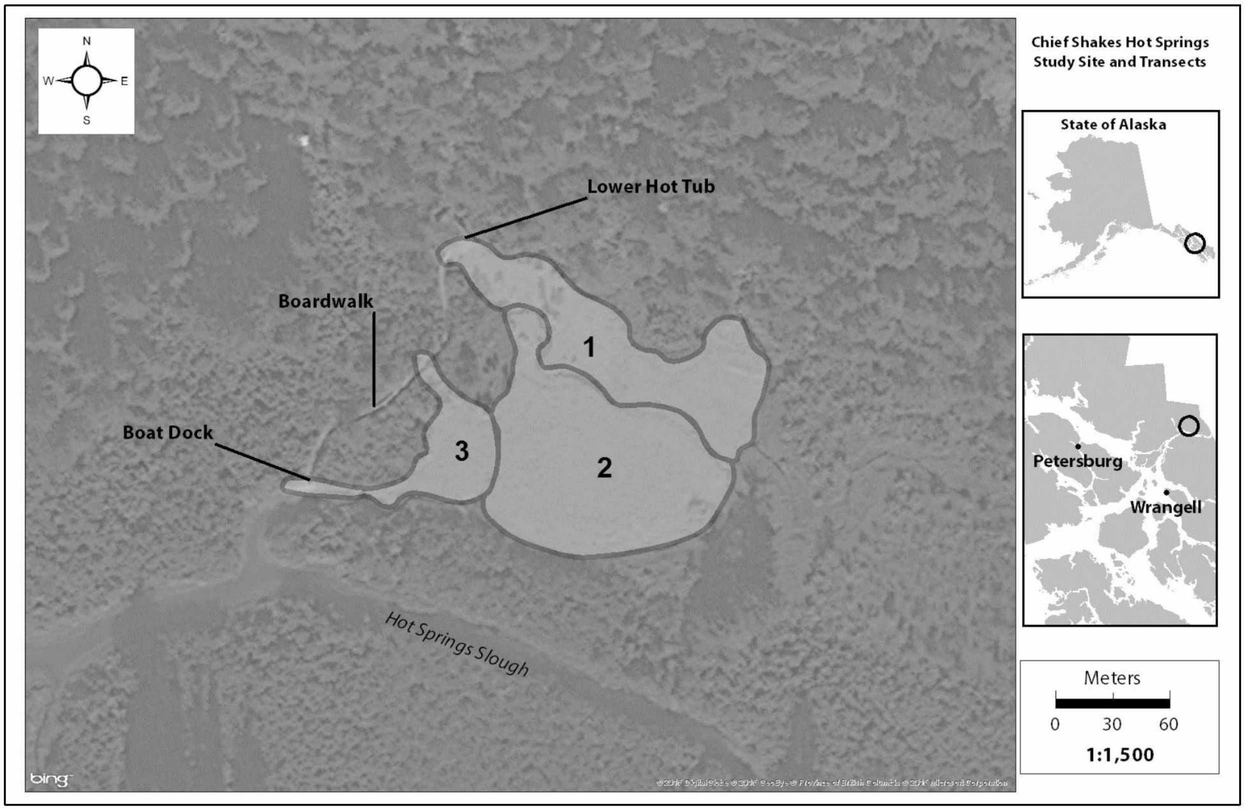

Figure 4.2. Chief Shakes Hot Springs study site and transects map.

Chief Shakes Hot Springs is one of five long-term monitoring sites established by the Alaska Herpetological Society for its Stikine Long-term Amphibian Monitoring Program (SLAMP).

Table 4.1. Study Design, Timeline, and Hydrologic Conditions.[6]

Date Range	Sampling Program	No. Participants	Site	No. Transects	Stikine River Height (m)[1]
5/19/2014	Semi-Annual Inventory	2	Chief Shakes Hot Springs	3	6.25-6.40
5/20/14-5/22/14	Semi-Annual Inventory	2	Twin Lakes	17	5.64-6.40
6/5/14-6/8/14	Camp'Phibian Year 1	10	Twin Lakes	17	5.33-15.94
5/22/15-5/25/15	Camp'Phibian Year 2	9	Twin Lakes	17	6.40-6.86
5/24/2015	Camp'Phibian Year 2	9	Chief Shakes Hot Springs	3	6.71-6.86

1 River height calculated at gauging station located at 56.708056° N, 132.130278° W (USGS 2015)

[6] River height calculated at gauging station located at 56.708056° N, 132.130278° W (WGS84; USGS 2015). The mean river height from mid-May to mid-June (2008-2015) was 5.59m ± 1.03m within a min-max range of 2.68 - 8.02 m.

Table 4.2. Amphibian Observations by Species, Life Stage and Sex.

Highlighted cells represent Camp'Phibian events. "-" indicates that no data is available. Abbreviations represent the following: *Anaxyrus boreas* (ANBO), *Lithobates sylvaticus* (LISY), *Rana luteiventris* (RALU), *Taricha granulosa* (TAGR), *Ambystoma macrodactylum* (AMMA), and *Ambystoma gracile* (AMGR).

	ANBO			LISY			RALU			TAGR			AMMA			AMGR			
	May 2014	June 2014	May 2015	May 2014	June 2014	May 2015	May 2014	June 2014	May 2015	May 2014	June 2014	May 2015	May 2014	June 2014	May 2015	May 2014	June 2014	May 2015	TOTAL
TWIN LAKES SITE																			
Adults	**17**	**13**	**12**	**0**	**0**	**0**	**0**	**1**	**3**[2]	**3**	**4**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	54
Males	17	9	5	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	34
Females	0	3	7	0	0	0	0	0	0	2	4	2	0	0	0	0	0	0	18
Unknown	0	1	0	0	0	0	0	0	3	0	0	1	0	0	0	0	0	0	5
Subadults	**5**	**2**	**310**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	317
Tadpoles / Larvae	**0**	**1**[1]	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	1
Egg Masses	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Subtotal	**22**	**16**	**322**	**0**	**0**	**0**	**0**	**1**	**3**	**3**	**4**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**375**
SHAKES HOT SPRINGS SITE																			
Adults	**2**	-	**0**	**0**	-	**0**	**1**	-	**8**	**16**	-	**0**	**0**	-	**0**	**0**	-	**0**	27
Males	2	-	0	0	-	0	0	-	3	5	-	0	0	-	0	0	-	0	10
Females	0	-	0	0	-	0	1	-	2	11	-	0	0	-	0	0	-	0	14
Unknown	0	-	0	0	-	0	0	-	3	0	-	0	0	-	0	0	-	0	3
Subadults	**8**	-	**86**	**0**	-	**0**	**18**	-	**0**	**0**	-	**0**	**0**	-	**0**	**0**	-	**0**	112
Tadpoles / Larvae	**789**	-	**18**	**0**	-	**0**	**0**	-	**0**	**0**	-	**0**	**0**	-	**0**	**0**	-	**0**	807
Egg Masses	**0**	-	**0**	**0**	-	**0**	**0**	-	**0**	**0**	-	**0**	**0**	-	**0**	**0**	-	**0**	0
Subtotal	**799**	**-**	**104**	**0**	**-**	**0**	**19**	**-**	**8**	**16**	**-**	**0**	**0**	**-**	**0**	**0**	**-**	**0**	**946**
GRAND TOTAL	**821**	**16**	**426**	**0**	**0**	**0**	**19**	**1**	**11**	**19**	**4**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**1321**

[1]Single observation represents greater than 100,000 tadpoles

[2]Animals suspected to be RALU but unverified

Table 4. 3. Amphibian Observations at Site and Transect.

Numbers represent individual amphibian observations. Bolded numbers represent animals captured with minnow traps. Highlighted cells represent Camp'Phibian events. Highlighted records indicate that minnow traps were used. "-" indicates that no data is available. Abbreviations represent the following: *Anaxyrus boreas* (ANBO), *Lithobates sylvaticus* (LISY), *Rana luteiventris* (RALU), *Taricha granulosa* (TAGR), *Ambystoma macrodactylum* (AMMA), and *Ambystoma gracile* (AMGR).

	ANBO			LISY			RALU			TAGR			AMMA			AMGR			
Transect	May 2014	June 2014	May 2015	May 2014	June 2014	May 2015	May 2014	June 2014	May 2015	May 2014	June 2014	May 2015	May 2014	June 2014	May 2015	May 2014	June 2014	May 2015	**TOTAL**
TWIN LAKES SITE - Easternmost Lake																			
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	3	67	0	0	0	0	0	0	0	**2**	**2**	0	0	0	0	0	0	74
3	0	0	11	0	0	0	0	1	0	**2**	0	0	0	0	0	0	0	0	14
4	0	1	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
5	0	2	32	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	37
6	0	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34
7	1	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
8	2	1	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33
9	1	2	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18
Subtotal	4	9	202	0	0	0	0	1	3	2	2	2	0	0	0	0	0	0	**225**
TWIN LAKES SITE - Westernmost Lake																			
10	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19
11	0	1	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
12	0	0	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27
13	0	0	13	0	0	0	0	0	0	**1**	**2**	**1**	0	0	0	0	0	0	17
14	0	3	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34
15	2	0	4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	7
16	2	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
17	14	3[1]	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22
Subtotal	18	7	120	0	0	0	0	0	0	1	2	2	0	0	0	0	0	0	**150**
SHAKES HOT SPRINGS SITE																			
1	23	-	33	0	-	0	4	-	2	0	-	0	0	-	0	0	-	0	62
2	776	-	67	0	-	0	11	-	6	0	-	0	0	-	0	0	-	0	860
3	0	-	4	0	-	0	4	-	0	**16**	-	0	0	-	0	0	-	0	24
Subtotal	799	-	104	0	-	0	19	-	8	16	-	0	0	-	0	0	-	0	**946**
GRAND TOTAL	**821**	**16**	**426**	**0**	**0**	**0**	**19**	**1**	**11**	**19**	**4**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**1321**

[1] Tadpoles were present in large numbers but not recorded as part of this table.

Table 4.4. Amphibian observations at Twin Lakes and Chief Shakes Hot Springs over time. Abbreviations represent the following: *Anaxyrus boreas* (ANBO), *Lithobates sylvaticus* (LISY), *Rana luteiventris* (RALU), *Taricha granulosa* (TAGR), *Ambystoma macrodactylum* (AMMA), and *Ambystoma gracile* (AMGR). "B" indicates breeding sites where amphibians were observed as eggs, tadpoles/larvae, newly transformed metamorphs, amplecting pairs, or chorusing. Gravid females are not included in the criteria since they may oviposit at a location other than that of capture. "Y" indicates sites where amphibians were observed but there was no evidence of breeding activity. "N" indicates sites where no amphibians were observed. "-" indicates that no data is available.

	TWIN LAKES						SHAKES HOT SPRINGS					
Study	**ANBO**	**LISY**	**RALU**	**TAGR**	**AMMA**	**AMGR**	**ANBO**	**LISY**	**RALU**	**TAGR**	**AMMA**	**AMGR**
Hodge (1972-1973)	Y	Y	Y	N	Y	N	-	-	-	-	-	-
Waters (1991)	B	N	B	B	N	B	B	N	Y	N	N	N
Norman and Hassler (1991-1992)	B	N	B	B	N	N	B	Y	B	B	N	N
Ream and Lopez (2010-2013)	Y	N	B	Y	N	N	B	Y	Y	B	N	N
This Study (2014-2015)	B	N	Y	Y	N	N	B	N	Y	Y	N	N

NOTE: Hodge (1972-1973) lists a *L. sylvaticus* from Hot Springs (Stikine River) but there is no additional description.

Chapter 5 Herpetological Citizen Science and Service-learning in Rural Southeast Alaska[1]

5.1 Abstract

Citizen science and service-learning projects can serve to acquire biological data, educate the general public, and inspire community-based conservation. In Alaska, these programs are particularly valuable in studying species for which limited population data is available and funding to ascertain the data is limited, such as for amphibians. We utilized an amphibian-oriented bioblitz (AmphiBlitz) and a high-school service learning project to obtain species diversity and distribution information for amphibians at three sites (Petersburg Baseball Field Muskegs, Mallard Slough, and Cheliped Bay) in proximity to the Stikine River in Southeast Alaska. A total of 707 individual amphibians of 4 species (3 anurans and 1 urodele) were observed by 21 project participants. These data support the Alaska Herpetological Society's Stikine Long-term Amphibian Monitoring Program (SLAMP). Data collected for the Petersburg Baseball Field Muskegs site are to serve as a baseline for long-term monitoring to be conducted annually in partnership with the Petersburg High School.

5.2 Introduction

Collaborative research provides tools for fostering trust, mutual understanding, and novel ecological insights (Parrado-Rosselli 2007, Gearheard and Shirley 2007, Huntington et al. 2011). Citizen science and service-learning projects are two collaborative approaches that have been employed by several institutions to obtain biological data for a variety of taxonomic groups (Sullivan et al. 2009, Belt and Krauseman 2012, Moyer-Horner et al. 2012, Worthington et al. 2012, Paul et al. 2014). While program specifics vary, the premise of these methods is often to utilize volunteers to maximize data collection while minimizing costs (Conrad and Hilchey 2011, Paul et al. 2014). In addition to the acquisition of biological data that can be utilized by researchers and natural resource managers, these programs also serve to provide public education and outreach opportunities and to involve local stakeholders in local research initiatives (Conrad and Hilchey 2011). In turn, such programs can inspire community-based conservation efforts and

[1] Ream, J.T. and S. Perry. 2016. Herpetological Citizen Science and Service-learning in Rural Southeast Alaska. *In-prep.*

continued support of and contributions to biological monitoring priorities (Berkes 2004, Conrad and Hilchey 2011).

Service-learning programs are a subset of citizen science that provides meaningful, hands-on research opportunities to students enrolled at academic institutions (Barlow 2012, Gorman 2010, Huard 2011). The programs often involve the development of partnerships between teachers, students, and researchers. Student participants are asked to participate in and contribute to ongoing research initiatives. Reciprocally, researchers can provide training opportunities, educational materials, classroom support and public acknowledgement of participant contributions. In this way, collaborators contribute to shared goals and outcomes.

These types of citizen science programs can be particularly valuable in the collection of data that may otherwise remain unavailable due to financial and logistical constraints by providing an extensive, cost-efficient, and long-term labor force (Conrad and Hilchey 2011, Gouveia et al. 2004, Paul et al. 2014). Research constraints are frequently realized in Alaska where vast landscapes and seascapes make many research initiatives cost prohibitive. Some projects have attempted to use citizen science programs in rural communities to circumvent these research limitations (e.g. Carstensen et al. 2003, Tessler et al. 2014). Data resulting from these studies has contributed to research and management of natural resources in the state. The data has also provided insight on the cultural, economic, aesthetic, and recreational ecosystem services provided by fish and wildlife species.

Species that are not typically consumed by humans sometimes receive less attention in research than those species on which humans directly depend (Delibes-Mateo et al. 2014, Morse-Jones et al. 2012). In Alaska, the state's six known native species of amphibians fall into this category. For these species in Alaska, some special interest groups have sought to utilize citizen science as alternative means of acquiring data and local herpetological knowledge (LHK) on amphibian diversity, distribution and abundance in the state (ADFG 2015, Carstensen et al. 2003). In addition, the Alaska Herpetological Society (AHS) was formed in 2012 and includes in its mission statement a commitment to providing "opportunities in outreach, education, and citizen science" (AHS 2015).

To support AHS' goals and to advance herpetological knowledge in Alaska, this project utilized citizen science and service-learning programs in the study of amphibians in the Stikine River region of Alaska (Fig. 1), as part of the organization's Stikine Long-term Amphibian Monitoring Program (SLAMP). We report here on the development of these programs and their outcomes, including the resulting data on the amphibian populations that were studied. We also compare these methods and results with previous herpetological studies in the region.

5.3 Methods

5.3.1 Study Sites

This study took place at three sites in proximity to the Stikine River in Southeast Alaska. An amphibian-oriented bioblitz that was open to the public was held at the Petersburg Baseball Field Muskegs (Fig. 2) while the service learning project inventory sites were at Mallard Slough and Cheliped Bay (Fig. 3) in the Stikine-LeConte Wilderness Area. These sites are characterized by the coastal temperate rainforest in which they are located.

5.3.1.1 Petersburg Baseball Field Muskegs

The Petersburg Baseball Field Muskegs are located on public land within the borough of Petersburg, a community situated at the northern end of Mitkof Island. It is approximately 50km from the mouth of the North Arm of the Stikine River. This wetland area does not have a formal name, but is located adjacent to the community's baseball fields. It encompasses approximately 316ha and is comprised of small shallow pools interspersed throughout the extent of the muskeg. Conifers (primarily *Pinus contorta*) are scattered throughout this wetland. Residential structures and roads surround the periphery of the wetland, and some foot trails are present between these. The city has plans to construct a trail / boardwalk through this wetland in the near future.

This site was selected for the AmphiBlitz because 1) it is easily accessible for community members, 2) the wetland has relatively well-defined boundaries, 3) there is a historically documented breeding population of Columbia Spotted Frogs (*Rana luteiventris* Thompson) present (Norman and Hassler 1995) and 4) local herpetological knowledge suggests that amphibians have declined substantially at the site over the past several decades (Ream and Carothers 2016, Ream and Lopez 2016). In addition, the partnership between AHS and the Petersburg High School provides for long-term monitoring of this site, including the documentation of water quality parameters over time. Annual monitoring will provide amphibian population data, and may offer insights on the effects of future development on these populations, including the installation of foot paths and boardwalks.

5.3.1.2 Mallard Slough & Cheliped Bay

These sites are located on Alaska's mainland within the Stikine-LeConte Wilderness Area in the Tongass National Forest. Both sites are accessible by boat from Petersburg (approximately 50km) or from Blaquerie Point (approximately 30km) at the southeastern end of Mitkof Island. They were chosen as inventory sites for the service-learning program because 1) both sites have been historically sampled for amphibians (Norman and Hassler 1995, Waters 1992), 2) they are included as long-term monitoring sites in SLAMP, 3) their documented amphibian species diversity provided students with additional learning opportunities and 4) documented populations of *R. luteiventris* abundance provided students with the ability to compare these populations with those at the Petersburg Baseball Field Muskegs. Both sites are tidally influenced and situated between the mouth of the north Arm of the Stikine River and its confluence with LeConte Bay.

Mallard Slough is characterized by several habitat types. The slough is brackish and is fed by several small freshwater tributaries. At its mouth the slough runs alongside the mainland shore for approximately 2km before turning eastward and stretching approximately 4km through an extensive meadow (primarily *Carex* spp) that is approximately 1km wide. The shoreline along the mouth is characterized by a short (approximately 50m) rock-mud beach and sedges below the forest boundary. Alder stands are present along much of this extent and they gradually give way to mature conifer forest. The forest floor is characterized by many small shallow pools and abundant skunk cabbage (*Lysichiton americanus*), particularly on the southernmost stretch of the forest boundary.

The study area at Mallard Slough included the entire stretch of beach along the mouth of the slough, from the tideline to the forest's edge. A transect was also established within the southernmost edge of the forest, extending from the forest's edge inward approximately 100m. A third transect was established within the meadow from the northern edge of the slough to the forest boundary. Of the meadow's approximately 500 ha along Mallard Slough, this study sampled approximately 76ha.

A public use cabin is situated along the Mallard Slough shoreline and this was utilized for lodging during this project. A trail behind the cabin connects Mallard Slough with Cheliped Bay through the mature conifer forest and over a steep hill for a distance of approximately 600m. Cheliped Bay can also be accessed by following the beach north along Mallard Slough. Cheliped Bay is at the mouth of LeConte Bay which is tidal. Both bays frequently contain large quantities of floating ice from the LeConte Glacier, and this ice commonly settles along the shore of Cheliped Bay. Cheliped Bay includes approximately 6km of shoreline, but only the southern and westernmost subsection of this area was sampled in this study – an area extending from the northernmost tip of mallard slough eastward approximately 2km. Above the tideline is an extensive array of small streams, sloughs, and shallow freshwater and brackish water pools interspersed throughout an extensive grassland encompassing approximately 520ha. We inventoried approximately 34ha of this area in this study. Above the grassland, this site gives way to a short stand of alders before transitioning to mature conifer forest.

Though most of the inventoried area in Cheliped Bay was within the grasslands / wetlands below the forest boundary, a small pond at the westernmost edge of the site was also sampled. This pond is approximately 200m in length and 20m wide at its widest point. A small stand of mature Sitka Spruce (*Picea sitchensis*) flanks the northern edge of this pond. An alder stand and the boundary of the mixed conifer forest flank the southern edge of the pond.

5.3.2 Sampling

5.3.2.1 Amphibian Bioblitz (AmphiBlitz)

Rapid biodiversity assessment programs referred to as a “BioBlitz” have gained notoriety as a means of collecting valuable scientific information while increasing public awareness of local species and promoting awareness of conservation issues (Karns et al. 2006, Karns et al. 2010). The programs are designed to rapidly assess the flora and fauna present in an area at a particular point in time (Ruch et al. 2014). For this project we tailored the traditional bioblitz to target amphibians in what was coined an “amphibian bioblitz” or “AmphiBlitz.” This program was designed to correspond with the Rainforest Festival in Petersburg, AK. On the morning of 9 September 2014, a public lecture on the amphibians of the Stikine River was offered by AHS at the Petersburg Public Library. This lecture was intended to provide an overview of local herpetological research in the region over time, but also to provide species identification training to attendees. The lecture was attended by 16 members of the public.

Also on 7 September 2014, the AmphiBlitz program was held at the Petersburg Baseball Field Muskegs from 15:00 through approximately 17:30. The event was attended by 18 participants, including four of the students participating in the service-learning program. A check-in station was established in the parking lot where participants were trained, provided with observation kits, and assigned transects. Groups of 2-3 participants were asked to walk transects with distances ranging from approximately 0.5km to approximately 4km. Of the 10 transects that were established prior to the program, 7 transects were walked by participants.

Kits provided to participants included amphibian identification guides, cameras, tally clickers, observation forms, rulers, aquarium nets, writing utensils and site maps. Participants were asked to record the number, species, and life stage of all amphibians observed in their assigned transect, and to mark their maps with the relative location where amphibians were seen. After participants returned from their assigned transects, AHS staff recorded their observations on master data forms and recollected the observation kits.

5.3.2.2 Systematic Surveys

The systematic amphibian surveys were part of a service-learning program established in conjunction with the Petersburg High School (see Fig.4). On 8 September 2014, six students and three adult volunteers travelled to Mallard Slough. A base camp was established at the public use cabin, and students were trained to conduct herpetological inventories. Each student was provided a kit similar to those used during the AmphiBlitz program, but with the addition of latex gloves, GPS units, scales, and large aquatic nets. Three large transects were searched between 17:45 and 19:10. Participants walked in semi-straight lines and were situated approximately 5-10m apart. Small woody debris was lifted temporarily, tall sedges were moved with nets, and the edges of small wetland pools were dipnetted to locate amphibians.

All amphibians sighted were recorded with species, life stage, and sex when possible. Some anurans could not be identified to species because they were only temporarily seen, so "*Rana* spp" and "*Anura* spp" were also used as higher taxonomic groups for recording purposes. Up to two amphibians of each life stage of each species were captured, measured (mass and snout-vent length [SVL]), photographed and released. The total number of each species observed in each transect was recorded before moving to the subsequent transect.

Between 19:20 and 19:45 on 8 September 2014, a total of eight unbaited minnow traps were deployed at the Cheliped Bay site, four in transect 1, and four in transect 2. Specific site selection was haphazard and by student choice. These traps were checked and removed the morning of 9 September 2014. All amphibians captured were recorded by species, life stage, and sex when possible. After processing all minnow traps, both transects at Cheliped Bay were sampled in the same fashion as Mallard Slough the previous day. The Cheliped Bay site was sampled from 8:50 until 11:58.

All data collected in this study was compiled by AHS. The data was then compared against previous data from amphibian inventories conducted at these sites. All resulting data was then returned to students for use in the classroom as an education tool for scientific analysis and the creation of maps, tables, and figures. Sampling kits were also checked out to the school on a semi-permanent basis to facilitate annual sampling.

5.4 Results

A total of 707 individual amphibians of 4 species were recorded in this study (Table 1). *Anaxyrus* (*Bufo) boreas* (Baird and Girard) was encountered most frequently (n=186), followed by *Rana luteiventris* (n=487), *Lithobates (Rana) sylvaticus* LeConte (n=20), and *Ambystoma macrodactylum* Baird (n=5). *Anaxyrus boreas* was only observed at Mallard Slough and all but one adult individual of this species were described as juveniles or metamorphs. No specimens of *Taricha granulosa* (Skilton) or *Ambystoma gracile* (Baird) were encountered in this study.

Only 10 individual amphibians were observed at the Petersburg Baseball Field Muskegs. All amphibians observed were of a single species, *Rana luteiventris*. These amphibians were comprised of 8 adults and 2 juveniles or metamorphs. Herpetological inventories conducted at this site and reported on in Chapter 6 (Ream and Lopez, 2016) failed to identify any juveniles, metamorphs, or viable egg masses, but inventory transects were substantially smaller in size.

Mallard Slough was the most herpetologically diverse site in this study, with four amphibian species encountered. A total of 214 amphibians were observed at this site. *Anaxyrus boreas* was most frequently encountered (n=186), followed by *L. sylvaticus* (n=12), *R. luteiventris* (n=8), and

A. macrodactylum (n=4). All but two of the amphibians observed at Mallard Slough were recorded as juveniles or metamorphs.

Sixty-eight percent (n=483) of individual amphibians observed in this study were encountered at Cheliped Bay. Of these observations, 97% (n=469) were *of R. luteiventris*, comprised of 440 juveniles or metamorphs, 23 adults and 6 tadpoles. No adults or tadpoles of any other species were encountered at this site. Eight juveniles or metamorphs of *L. sylvaticus* were observed, and a single juvenile individual of *A. macrodactylum* was observed. We observed *A. macrodactylum* egg masses here (Ream and Lopez 2016), but no juveniles or adults.

5.5 Discussion

As a component of SLAMP, this study provided several key benefits to the AHS' monitoring program. First, it provided the organization with the ability to explore alternative methods of data acquisition using citizen science and service learning programs. By utilizing public volunteers and K-12 students, wetland sites were able to be sampled more intensively and thoroughly than if this had been undertaken by only one or two members of AHS' staff. Because these volunteers are now trained and partnerships are in place, AHS can continue to benefit from the continued collection of volunteer observations.

A second benefit of this study was the ability to cover large tracts of land over relatively small time intervals. Importantly, SLAMP's previous monitoring activities have taken place in the spring and have been scheduled to correspond as closely as possible to the peak of amphibian breeding. The timing of funding availability, coordination with the Rainforest Festival, and the availability of students resulted in this project taking place in the early fall. While this is inconsistent with previous efforts, it also provided an opportunity to observe differences in amphibian populations, life stages, and habitats at a different time of year.

The results of the AmphiBlitz program are particularly important because this site is slated to be monitored annually by students, and because of community concerns regarding amphibian declines at this site. Though 10 individuals of *R. luteiventris* were observed here, the density of frogs here was minimal as compared to the presence of this species at Cheliped Bay. One volunteer noted that when he was a child approximately 30 years ago, the density of *R. luteiventris* at the Baseball Field Muskegs was similar to that of Cheliped Bay presently. The decline may have occurred since Norman and Hassler (1995) surveyed the site in 1992, indicating that “large breeding concentrations of spotted frogs and/or eggs, larvae, and/or young-of-the-year transformed froglets were observed.”

The suspected decline of *R. luteiventris* on northern Mitkof Island is not well documented, and the causes of this decline are unclear. Norman and Hassler (1995) recorded observations of dead frogs in small muskeg pools on the northern end of Mitkof Island, particularly in those with evidence of pool use by Mallard ducks, *Anas platyrhynchos*. They also observed the presence of symbiotic algae on “nearly every spotted frog egg mass seen in the wild in the 1992 Alaskan field work.” These researchers furthermore described fungal spoilage of spotted frog egg masses on both Mitkof Island and at Mallard Slough. We observed two such masses at the Baseball Field Muskegs in 2012 (Ream and Lopez 2016). We hope that continued monitoring of the frog population and habitat at this site will result in additional insights.

Mallard Slough and Cheliped Bay remain among the most herpetologically diverse sites sampled under SLAMP. Interestingly, *A. boreas* was not found at Cheliped Bay during this study or during the herpetological inventories at the site reported on in Chapter 6 (Ream and Lopez 2016). Waters (1992) and Norman and Hassler (1995) did however observe this species at the Cheliped Bay site. We expect that continued monitoring will provide additional insight on local amphibian assemblages and changes to these over time.

This project was successful in surveying the three selected wetlands for amphibians, and in providing public outreach and education opportunities. Both citizen science programs (AmphiBlitz and the Service-Learning Project) were successful in providing real-world hands on learning opportunities for members of the public and K-12 students. Participants were excited to participate in these programs, and many offered their LHK on past observations of amphibians on local landscapes. One student described the experience as follows:

> “Overall, the trip out to the Stikine Flats was very fun and we learned many things. For example, before this trip I never knew that there were multiple kinds of frogs on the islands let alone being able to tell them all apart. By going on this trip, I am now able to tell the difference between the frogs and be able to tell the scientific name for each. Even though the days seem like they were taking a long time and the mosquitoes were horrible, the weather was amazing and everyone was very nice. Being able to learn about the frogs

> and salamanders on the islands was very exciting because now when I go out to Blind Slough with my friends; [it] allows me to show off my new knowledge of the frogs and to help them learn as well."

Another student reflected that:

> "The field trip was a great experience to get out and see how real monitoring projects are conducted and I thoroughly enjoyed it. I got to see more of the wildlife within my own extended backyard that piqued my interest. I have to thank Josh for the opportunity for our class to take part in SLAMP because it has helped shape what I want to do with my own life."

The results of this study also provide valuable datasets on amphibian diversity, distribution, and life histories in the region. It furthermore provides baseline population data for ongoing partnerships between AHS, the Petersburg High School, and the U.S. Forest Service. We recommend that researchers consider utilizing similar citizen science and service-learning program techniques, especially where funding is limited.

5.6 Acknowledgments

We would like to thank the Perry family, J. Kludt-Painter, K. Hess, J. Johnson, L. Johnson, R. Quitslund, S. Morton, I. Fleming, K. Hagerman, and M. Milovidova for their participation and contributions to this project. We also thank the Borough of Petersburg, AK, the Petersburg Rainforest Festival Committee, the Petersburg Public Library, the Alaska Forum on the Environment and the entire community of Petersburg, AK for helping to make these programs possible.

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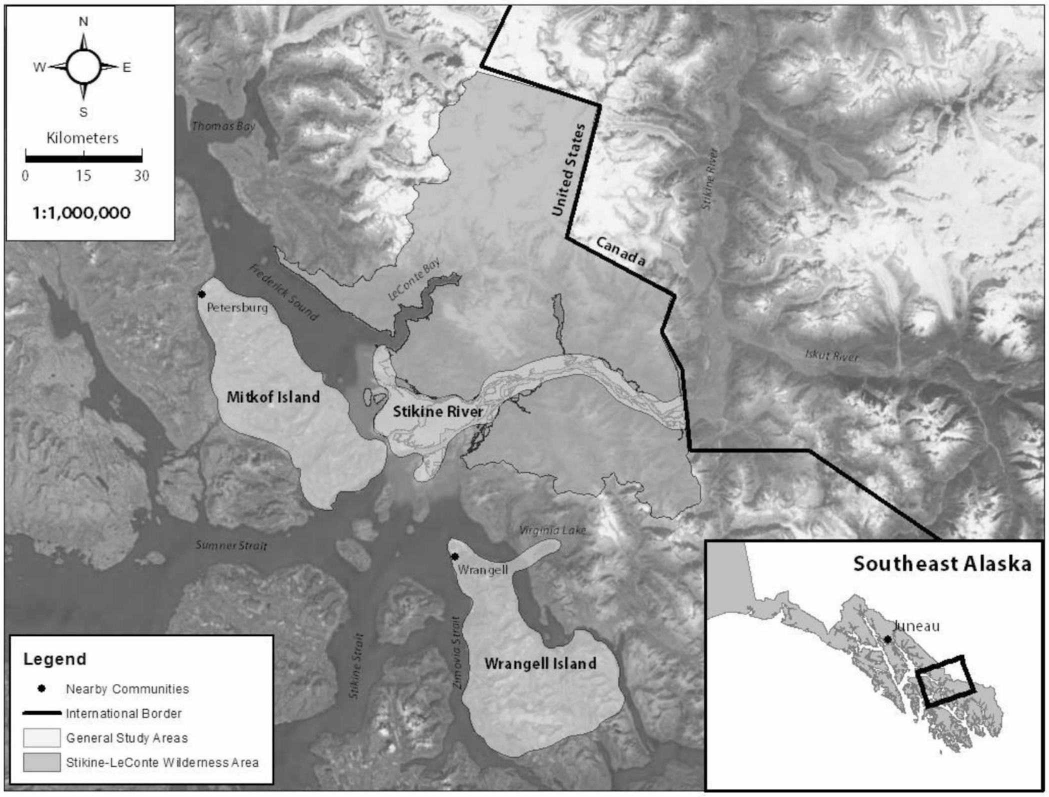

Figure 5.1. General study area of the Alaska Herpetological Society's (AHS) Stikine Long-term Amphibian Monitoring Program (SLAMP).

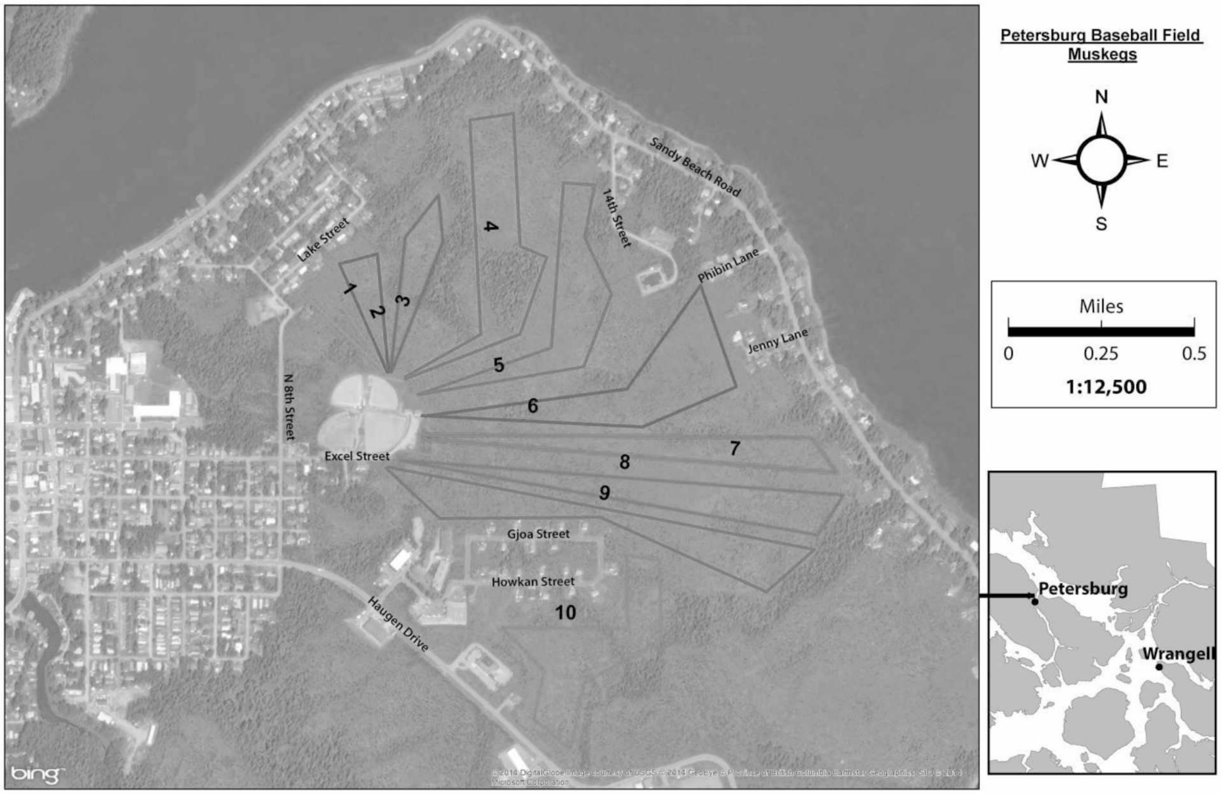

Figure 5.2. Location of transects at Petersburg Baseball Field Muskegs, Petersburg, AK.

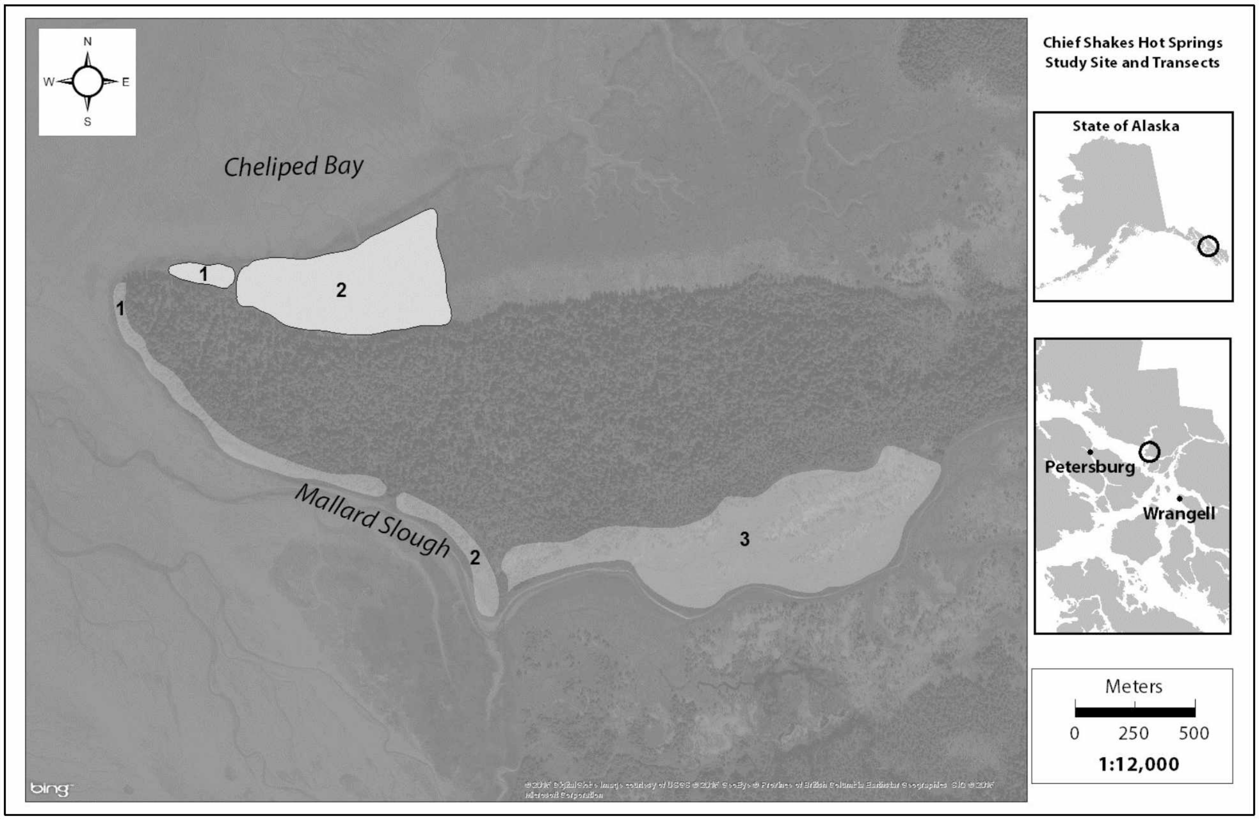

Figure 5.3. Location of transects at Mallard Slough and Cheliped Bay, Stikine-LeConte Wilderness Area, Tongass National Forest, Alaska.

Figure 5.4. Photograph of Petersburg High School's Advanced Placement Biology Class participating in an amphibian inventory at Mallard Slough in the Stikine-LeConte Wilderness Area of Alaska.

Table 5.1. Amphibians observed between September 7-9, 2014, by species, life stage, and location.

Abbreviations represent the following: *Anaxyrus* (*Bufo) boreas* (*ANBO*), *Lithobates* (*Rana) sylvaticus* (*LISY*), *Rana luteiventris* (RALU), *Taricha granulosa* (TAGR), *Ambystoma macrodactylum* (AMMA), *Ambystoma gracile* (AMGR). Amphibia spp., Anura spp. and Rana spp. represent amphibians that were identified to order or genus but not to species.

	SPECIES								
Site & Life Stage	**ANBO**	**LISY**	**RALU**	**TAGR**	**AMMA**	**AMGR**	**Anura spp.**	**Rana spp.**	**TOTAL**
Petersburg Baseball Field Muskegs	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**10**
Adult	0	0	8	0	0	0	0	0	8
Juvenile or Metamorph	0	0	2	0	0	0	0	0	2
Tadpole	0	0	0	0	0	0	0	0	0
Egg Masses	0	0	0	0	0	0	0	0	0
Mallard Slough	**186**	**12**	**8**	**0**	**4**	**0**	**1**	**3**	**214**
Adult	1	0	0	0	1	0	0	0	2
Juvenile or Metamorph	185	12	8	0	3	0	1	3	212
Tadpole	0	0	0	0	0	0	0	0	0
Egg Masses	0	0	0	0	0	0	0	0	0
Cheliped Bay	**0**	**8**	**469**	**0**	**1**	**0**	**0**	**5**	**483**
Adult	0	0	23	0	0	0	0	0	23
Juvenile or Metamorph	0	8	440	0	1	0	0	5	454
Tadpole	0	0	6	0	0	0	0	0	6
Egg Masses	0	0	0	0	0	0	0	0	0
TOTAL	**186**	**20**	**487**	**0**	**5**	**0**	**1**	**8**	**707**

Chapter 6 Herpetological Inventory Results from the Stikine River Region of Alaska[1]

6.1 Abstract

We conducted 3 years of herpetological inventories in the Stikine River Region of Southeast Alaska between 2010 and 2013. A total of 5 amphibian species represented by 454 individuals from this region were documented from 30 sites. Occurrence and breeding activity was compared to historical data to evaluate population change over time. Site-specific assemblages were largely similar to historic accounts, with several key differences, including apparent declines at the Baseball Field Muskegs and Blind Slough sites on Mitkof Island. Our study includes several sites on Wrangell Island that had not been previously surveyed. Among sampled sites, Twin Lakes Warm Springs, Shakes Hot Springs, Sergief Island, Mallard Slough and Paradise Slough had the most abundant populations, and each served as breeding habitat for one or more species. Twin Lakes, Shakes Hot Springs and Paradise Slough exhibited the greatest species diversity, with 4 amphibian species being documented at each. We documented new geographic distribution records for *Ambystoma macrodactylum*, and we confirmed the presence of this species at Twin Lakes where it was previously suggested to have been extirpated. We also confirmed the presence of *Rana luteiventris* from Muskeg Meadows Golf Course on Wrangell Island. We were unable to verify the presence of *Ambystoma gracile* or *Thamnophis sirtalis* in this region. This study provides substantial baseline amphibian population data that can be referenced in future inventories of the region.

6.2 Introduction

Six species of amphibians are known to occur naturally in Alaska (Hodge 1976), and these have thus far received relatively little attention from researchers and resource managers. Baseline population data is largely absent for these species in Alaska (ADF&G 2006) even though amphibians are thought to be excellent environmental indicators (Muths and others 2005), global warming trends are exacerbated at high latitudes (Anisimov and others 2007), diseases are emerging issues (e.g. Reeves and Green 2006, Reeves 2008) and some have pointed to possible correlations between human, amphibian, and ecosystem health (Hayes and others 2002).

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[1] Ream, J.T. and J. A. Lopez. 2016. Herpetological Inventory Results from the Stikine River Region of Alaska. *In-prep.*

Several studies have aimed at characterizing the geographic range for amphibians in Alaska (for example Tessler and Snively 2013, Anderson 2004, Hokit and Brown 2006, Carstensen and others 2003, Hodge 1976, Norman and Hassler 1995, Waters 1992). However, most of these had a limited taxonomic, geographic or temporal focus. The resulting information has been valuable, but of limited use for understanding long-term trends for individual species or watersheds. Importantly, many of these studies remain unpublished. A confounding difficulty has been the lack of centralized databases to house Alaska's amphibian locality information (Olson 2009), though recent efforts at both the University of Alaska Museum (UAM) and the Alaska Natural Heritage Program (ANHP) are beginning to rectify the situation.

The temperate rainforests of southeast Alaska are home to all six of the state's extant native amphibian species (Hodge 1976, MacDonald and Cook 2007). The Alaska portion of the Stikine River drainage (Fig. 1) and its nearby coastal islands is particularly herpetologically diverse, with all of the state's native amphibians having been identified here (Waters 1992). Several opportunistic surveys (for example Hodge 1976, MacDonald and Cook 2007), as well as intensive inventories in 1991 (Waters 1992) and 1992 (Norman and Hassler 1995) have reported on the amphibian fauna of this region. These historical datasets are among the most extensive for any region in the state, and they are among the few that report on herpetological assemblages in Alaska. These datasets serve as reference points from which to compare more contemporary efforts reported here.

We conducted a 3 y inventory of amphibians in the Stikine region using a combination of methods from natural and social sciences. The results of our herpetological field investigations are reported here; a synthesis of amphibian distribution using local and traditional knowledge observations and citizen science techniques are reported in the other chapters of this dissertation. Our targeted surveys in the region may serve as an appropriate amphibian population baseline for future monitoring efforts.

6.3 Methods

6.3.1 Study Region

Our study was conducted in the Stikine River region of Southeast Alaska (Fig. 1). The headwaters of the Stikine River begin in the Spatsizi Plateau region of British Columbia from which it flows for approximately 539km to the coast (Penn 2001). The watershed encompasses about 52,000 sq. km (Pahlke 2010) and represents the fastest free-flowing navigable river in North America (USDA 2013). Only the last 64km of the river occur within Alaska (AGS 1979). The mouth of the Stikine River is located approximately 220 km by air south of Juneau and approximately 315km by air north of Alaska's southernmost border with British Columbia. Wrangell and Petersburg are the closest communities to the mouth of the river. Wrangell is located on Wrangell Island, has a population of 2,369 (USCB 2010a), and is located about 5km south of the Main Arm of the Stikine River. Petersburg is located on Mitkof Island, has a population of 3,815 (USCB 2010b) and is located about 25km northwest of the North Arm of the Stikine River.

The Alaska portion of the Stikine River is largely within the Stikine-LeConte Wilderness Area, a 181,674 ha parcel (USDA 2012) within the Tongass National Forest (Fig. 1). It has been managed by the U.S. Forest Service since its creation by the U.S. Congress in 1980 under the Alaska National Interest Lands Conservation Act (ANILCA). As per wilderness regulations, there are no roads or permanent residences within the wilderness area, though motorized boat traffic and floatplanes are permitted (USDA 2012). Access to the river is along 3 recognized delta corridors known locally as the North Arm, Middle Arm, and Main Arm. Some permanent structures are located on exempt private lands on Farm Island, although these are completely surrounded by wilderness-designated areas. Mitkof and Wrangell Islands are not within the wilderness boundaries.

A spruce-hemlock rainforest dominates the Stikine LeConte Wilderness in areas with marine influence, while further upriver annual rainfall decreases and cottonwood stands with dense underbrush become more prevalent (USDA 2013). The river delta is extensive, encompassing 110 km^2, and includes tidal marshes, grass/mud flats and shifting sandbars (USDA 2013). The river valley lowlands consist of many side channels, streams and sloughs, muskegs, and alder/willow patches (USDA 2013). On the Alaska portion of the river, the Popof and Shakes glaciers are on the river's north flank. Two warm springs and a hot spring have been identified on the north side of the river (USDA 2013, Demerjian 2006). Shakes' Hot Springs (56.7269N, -132.0522W) is the best known among these and is now a popular recreational site. Twin Lakes (56.6976N, -132.2671W), a connected shallow overflow pond created by a stream, is also a popular summer recreation site because of its open expanse, shallow and relatively warm slow-moving water and relative ease of access by boat.

Specific sampling sites for the study were chosen based on accessibility, availability of historic data, known species diversity, and recommendations of local residents. A total of 30 sites in the Stikine region were sampled including six on Mitkof Island, nine on Wrangell Island (including nearby Virginia Lake), and 15 on or near the Stikine River (Figure 1). Not all sites were sampled in all three years or with the same intensity between sites due to issues of access, river conditions and weather.

6.3.2 Literature Review

Historic sites for contemporary comparison were identifies by a thorough literature review of all previous herpetological work in the Stikine region. While many opportunistic records of amphibians exist in museum collections and institutional databases, only two extensive amphibian inventories have been reported for the region (Waters 1992, Norman and Hassler 1995). In 1992, Norman and Hassler (1995) revisited many of the sites established by Waters in 1991 (Waters 1992). Amphibian observations of presence and breeding activity at each site in our study were compared against these historical observations.

6.3.3 Field Surveys

Field surveys were conducted in 2010, 2012 and 2013 (Table 1). The 2010 study year was considered a "pilot year" and included opportunistic sampling throughout southeast Alaska, from Haines in the north to Ketchikan in the south, beginning on 27 May 2010 and ending on 21 July 2010. More intensive sampling occurred on Mitkof Island and Wrangell Island between 30 May 2010 and 15 July 2010, especially at sites recommended by local residents. Targeted sampling occurred in the Stikine region in 2012 and 2013.

In 2010, transects were sampled with basic amphibian survey approaches (Heyer and others 1994, Olson 1997) using sight and sound for detection, and when standing water was present, the water and substrate were netted with a dipnet at 3m intervals along the shoreline. When possible, unbaited minnow traps were deployed for 6-12 hours. All amphibians encountered were recorded and when capture was possible, individual specimens were weighed, measured (snout-vent-length [SVL] and tail length [when appropriate]), and photographed. Precautions were taken to prevent the spread of disease and aquatic invasive species by wearing powderless latex gloves and scrubbing boots and equipment with a 5% bleach solution between sites.

Life stage was determined by relative size, the presence of breeding characteristics, and observed breeding behavior (i.e. chorusing, amplexus, egg laying). Sex was determined by external characteristics (i.e. genitalia, gravidity, forearm width, nuptial pads) and behavior (i.e. position in amplexus, chorusing). Individuals were released alive or preserved as voucher specimens and deposited in the herpetology collection at the University of Alaska Museum (UAM). Associated tissues samples for genetic analyses were also deposited at the UAM.

For the 2012 field season, the Stikine Region was selected as the focal area of study due to its known amphibian diversity, the availability of historic data, and the interest of local residents in participating in separate study components not reported here focusing on local and traditional knowledge. No field sampling occurred in 2011. In 2012 targeted sampling occurred between 16 May 2012 and 22 May 2012 at Stikine River and Mitkof Island sites (Table 1). Targeted sampling also occurred on Wrangell Island between 17 June 2012 and 20 June 2012. Targeted sampling was repeated at Stikine River sites between 31 May 2013 and 8 June 2013.

Sampling in 2012 relied on the same set of visual, auditory and specimen capture methods used in 2010. These also were used in 2013 and supplemented with unbaited minnow traps. When possible, photographic vouchers were taken of all amphibians encountered. No effort was made to collect voucher specimens, but animals that were found dead were preserved and sent to UAM. All amphibians encountered were recorded and when capture was possible, individual specimens were weighed, measured, and released alive at the site of capture.

6.3.4 Local ecological knowledge

Local ecological knowledge was collected alongside of this work. This was obtained through key respondent interviews, public forums, mailed surveys, opportunistic conversations, and online submission forms. Most contributed observations are reported in chapter 2 (Ream and Carothers, 2016). Several of these contributions are interspersed here as supplemental evidence for validating amphibian species occurrence.

6.4 Results

6.4.1 Species Records

In 2010, 2012, and 2013 the total number of individual amphibian observations was 62, 134, and 270 respectively, and 466 animals were recorded overall. The total number of amphibians observed during the study period on Mitkof Island, Wrangell Island, Virginia Lake and other areas of the Stikine region were 18, 71, 13 and 352 respectively (Table 2). Many surveys found similar amphibian assemblages to historic observations (Table 3). The most productive overall amphibian sites (all amphibian species combined) by number of observations in this study were Twin Lakes Warm Springs (n=93), Shakes Hot Springs (n=75), Sergief Island (n=54), Mallard Slough (n=29) and Twin Lakes (n=28).

At productive breeding habitats we generally observed many more individuals in addition to those recorded and measured (Table 2). This was the case for *Anaxyrus boreas* at Farm and Sergief Islands, *A. boreas* at Shakes Hot Springs, *Lithobates sylvaticus* and *R. luteiventris* at Cheliped Bay, *Ambystoma macrodactylum* at Mallard Slough and *Taricha granulosa* at Twin Lakes Warm Springs.

The most frequently encountered species over all three years were *T. granulosa* and *A. boreas,* with 223 and 149 individuals respectively. Sites with highest recorded abundances in a year for each species over the three years were Mallard Slough for *A. macrodactylum* (n=26), Cheliped Bay for *R. luteiventris* (n=14) and for *L. sylvaticus* (n=6), Twin Lakes Warm Springs for *T. granulosa* (n=93), and Sergief Island for *A. boreas* (n=54). No individuals of *Ambystoma gracile* were encountered at any site. Two individuals of *Pseudacris regilla* were encountered at Frog Pond near Ward Lake in Ketchikan in 2010. This is an introduced population and the species does not occur naturally in Alaska.

Our data records are supported with photographs (n=439), voucher specimens (n=26), visual (n=21) and/or auditory observations (n=3). Many of the occurrences reported in this study were documented in various formats (i.e. audio recordings and photographs), thus producing more archived records than individual amphibian observations.

6.4.2 Morphological Data

Most amphibians recorded in all three years were adults, though thousands of tadpoles of *A. boreas* were observed. During the years of targeted sampling (2012 and 2013), a morphological measurement was obtained from a total of 276 adult amphibians in the Stikine region (Table 4). The mean mass, SVL, and tail length (when appropriate) are presented in table 4.

Anaxyrus boreas adults were the largest of the species sampled, both by SVL (n=55, $\bar{x}$=70mm, s=10.1), and by mass (n=50, $\bar{x}$=43.6g, s=13.7). The shortest mean SVL was represented by adult *L. sylvaticus* (n=8, $\bar{x}$=50mm, s=4.1), and the lowest mean mass was that of *A. macrodactylum* (n=23, $\bar{x}$=3.5g, s=1.6). *Ambystoma macrodactylum* adults exhibited a mean tail length of 48 mm (n=25, s=11.3) and *T. granulosa* adults had a mean tail length of 88 mm (n=155, s=15.7).

6.5 Discussion

6.5.1 Overview

Our results contribute information for conservation planning as it relates to amphibians in the Stikine Region. This investigation is among few studies in Alaska to report on amphibian assemblages over time. We confirmed the continued occurrence of individual species and the utilization of breeding habitats at sites throughout the study area.

Results of this study have guided the selection of five permanent annual inventory sites on the Stikine River based on amphibian breeding activity and historical data availability: Mallard Slough, Cheliped Bay, Paradise Slough, Twin Lakes, and Chief Shakes Hot Springs. Accessibility and hydrologic variation were important considerations in choosing these sites, and should be considered when planning future monitoring efforts in the Stikine Region. Navigation on the Stikine River is often difficult given the remoteness of the area, tidal influences, fluctuating river levels and debris barriers. In our study, the combination of these factors often dictated our ability to access sites and the duration of stay at each site. In addition, climate conditions are quite variable along the river's length. At the mouth of the river, spring onset is much earlier than it is even a few kilometers upstream. When amphibian breeding begins in wetlands on the Stikine Delta, many areas above tidal influence remain under winter conditions with landscapes covered in ice and snow. The breeding phenology for a given species of amphibian is therefore variable among neighboring populations. Compounding this situation, the timing of spring onset and ice break-up is variable from year to year, making it difficult for logistical planning of field work.

6.5.2 Historical Comparisons

Many of the historical sites that were revisited during this study appear to exhibit a similar amphibian composition in more recent years. Observations of amphibian species at each site were compared against historical observations (Table 3) to gain perspectives on changes to populations over time. It is important to note that, though several general site areas visited by Waters (1991) and Norman and Hassler (1995) were revisited in this study, many sites are expansive and our inventory may not have precisely overlapped with historical transects. The historical inventories conducted by these authors were undertaken with varying degrees of intensity and in different months as compared to our study. In addition, differences between amphibian community compositions at each site between study years may be the result of variation in the timing of our sampling, the duration of sampling, and the intensity of sampling. Nevertheless, several noteworthy site-specific differences emerged between previous studies and the observations reported here.

6.5.2.1 Mitkof Island

The Baseball Field Muskegs and Blind Slough sites on Mitkof Island were previously documented as amphibian breeding habitat. Norman and Hassler (1995) described *R. luteiventris* breeding activity at the Baseball Field Muskegs in 1991. They also described *A. boreas* breeding activity at Blind Slough that same year, and museum records of this species show its was found there in 1976. Sampling for this project failed to identify amphibians of any life stage at these sites in 2010 and 2012, except for two nonviable anuran egg masses at the Baseball Field Muskegs in 2012. According to several residents of nearby Petersburg, both sites were historically known to have abundant amphibian populations and were described as “crawling with frogs and toads.” These local accounts and our own survey findings suggest that the amphibian productivity of these sites has changed in the last 20 years.

6.5.2.2 Stikine Delta

We document breeding activity at Cheliped Bay for both of the state’s native ranids, but we failed to verify the presence of *A. boreas* at this site. *Anaxyrus boreas* was documented here by both Waters (1992) and Norman and Hassler (1995), but these authors did not document bufonid breeding activity in the area. We believe that toads are likely present as occasional visitors, but that contemporary breeding sites are absent in near the sampled transects. At nearby Mallard Slough, both Waters (1992) and Norman and Hassler (1995) documented breeding activity for *R. luteiventris*, but we did not. Mallard Slough was the most productive breeding area for *A. macrodactylum* in our study.

The vast meadows and shallow wetlands in the lowlands of the delta islands of both Farm and Sergief provide extensive breeding habitat for *A. boreas* as is evidenced by the breeding activity and tadpole observations documented at these locations. This was the first reported inventory at Knig Slough, and *A. boreas* breeding activity was documented here. Egg masses of unknown ambystomatids were also documented, and though they were likely of *A. macrodactylum*, this was not confirmed. Norman and Hassler (1995) reported breeding activity for both *R. luteiventris* and *A. macrodactlum* at Binkley Slough. We report breeding activity for both *A. boreas* and *L. sylvaticus* at this location. It is unlikely that our transects were in the same location at Binkley Slough as those of Norman and Hassler (1995) who report having sampled more extensively in the east areas of the slough near a group of cabins primarily used for recreation. Members of 2 long-time resident households of this area reported breeding activity for *A. macrodactylum* near their homes, and they supplied us with photographic evidence.

The northeastern portion of Sergief Island was sampled more extensively and intensively than any other site in this study due to a three day stranding on the island in 2013. The only amphibian species documented here was *A. boreas*, but both adults and tadpoles were abundant (>10,000). Shallow pools in open semi-tidal grass flats, similar to those found near Binkley Slough on Farm Island, were present over a large expanse. Many of these contained *A. boreas* tadpoles at the time of our visit. While some adults were found in these open areas too, most adults were found in congregations within willow stands adjacent to the riverbanks. Others reported *A. boreas*, *R. luteiventris* and *L. sylvaticus* in this area in 1919 (Table 3). No known sampling besides our study has occurred here since, though both Waters (1992) and Norman and Hassler (1995) sampled the southeastern portion of the island.

Little Dry Island is located between Dry Island and Farm Island and it is nearly connected to Farm Island during very low tides. Waters (1992) did not document amphibians here. Norman and Hassler documented the presence of *A. boreas*. Our study documented *A. boreas* as present in 2012. We also report the 1st record of *A. macrodactylum* from this island. Though the island is relatively small, transects were restricted to the southern edge of the island due to a sub-optimal tidal schedule.

6.5.2.3 Stikine River

Several sites exhibited extensive amphibian activity further upstream on the U.S. portion of the Stikine River. The colder southern side of the river appears to be far less productive than the warmer south-facing slopes of the northern flank of the river, though few southerly sites were intensively sampled in our study. An exception to this is the Shakes Slough area, a region of the lower Stikine River that is locally referred to as the "ice box" and located on the northern side of the Stikine channel. The slough flows from a nearby glacial lake fed by the Shakes Glacier. Despite extensive searching, only a single adult of *R. luteiventris* was located in this area. Waters (1992) also reported this species as the only amphibian found at this site. Further upriver at Red Slough near the Canada border, our study documented the first *R. luteiventris* from this area.

Twin Lakes, when filled, covers an area of approximately 110ha. It is a shallow, clear and connected wetland that remains relatively warm throughout the summer. It typically fills in mid to late spring, but it exists as a large meadow with a small shallow stream throughout much of the summer. The warm water and vegetative cover provides excellent breeding habitat for ectothermic organisms. *Anaxyrus boreas* breeding activity was documented at this site by both Waters (1992) and by Norman and Hassler (1995). In our surveys, *Anaxyrus boreas* was recorded at this site but we did not observe breeding activity. This may have been due to early sampling in both 2012 and 2013. Local residents report that every year, Twin Lakes is "swarming with small black tadpoles by mid to late summer."

A warm spring located west of Twin Lakes (identified in this report as Twin Lakes Warm Spring) was among the most productive sites for *T. granulosa* encountered. In both 2012 and 2013, many newts of this species were observed breeding in both the source pools (approximately 20°C) and the shallow spring leading from them. At the nearby Twin Lakes Warm Spring, *T. granulosa* was observed in large breeding congregations in both 2012 and 2013. Neither Waters (1992) nor Norman and Hassler (1995) documented this species here, but it is possible that they visited another warm spring in the area that was not surveyed in this study.

Waters (1992) reportedly observed an egg mass of *A. gracile* at a Twin Lakes warm spring and this is discussed in further detail later.

Another geothermal wetland to the east of Twin Lakes, Shakes Hot Springs, is a popular recreational site on the Stikine River and is relatively easy to access by boat. The site has been developed to include a boat dock, boardwalk, shelters, and wooden hot tubs. Most amphibians were encountered in transects immediately downstream of these areas in a more open meadow containing several merging streams where the water temperature gradually cools. Like the Twin Lakes area, this meadow sometimes floods later in the season, forming a single pool. This was not observed during our surveys. Water temperatures exceeding 32°C were recorded at the source of the spring.

Anaxyrus boreas, *T. granulosa*, *R. luteiventris* and *L. sylvaticus* were observed at Shakes Hot Springs during our study. Tadpoles and metamorphs of *A. boreas* were found primarily in or near the warmest waters (26-28°C), and were the closest to the spring source in both 2012 and 2013. No egg masses were present by the time we arrived in either study year, and were presumably laid very early in the spring. *Taricha granulosa* was not observed here in 2012, but individuals were observed breeding in 2013, especially in areas with substantial algal growth and water temperatures between 20°C and 26°C. Most adult *R. luteiventris* were found in or near slightly cooler waters (approximately 16°C) downstream, but no breeding activity, egg masses, or tadpoles were observed for this species at this site. The 2 subadult *L. sylvaticus* found at this site was located farther downstream in or near substantially cooler water. Though they were not part of our study, lampreys were also observed spawning at this site in both years.

6.5.2.4 Wrangell Island

Our study is the first to survey for amphibians in Earl West Cove, Middle Ridge Cabin, Muskeg Meadows, Salamander Creek, and Thoms Lake on Wrangell Island. *Taricha granulosa* was common at many wetland sites on both Mitkof and Wrangell Islands. This species was found breeding in large numbers on Wrangell Island at the Wrangell Reservoir lakes, Pat's Lake, and Middle Ridge Cabin.

We provide the first report of breeding activity for *A. boreas* and *T. granulosa* at Muskeg Meadows Golf Course. Many local residents reported that they have observed both adults and tadpoles of *A. boreas* here, and some residents suggested that a species of "frog" is also sometimes present. We were unable to document any ranids at this site, though a local police officer provided photographic evidence of an adult *R. luteiventris*, the 1st formally documented occurrence of this species on Wrangell Island.

6.5.2.5 Virginia Lake

At Virginia Lake on the mainland, our study documented breeding activity for *T. granulosa* in 2010. This activity was observed in a small muskeg on the western shore of the lake near the public trail. An abundance of newts at this location was also reported by a Wrangell resident in a subsequent year. Another Wrangell resident indicated that this wetland "was swarming with newts when I was a kid, 60 years ago." Our study also documented the presence of *A. boreas* on the eastern edge of the lake.

6.5.3 Individual Species Accounts

An interesting observation made in 2012 is the positive identification of an adult *A. macrodactylum* at the Twin Lakes site along the Stikine River. Both Norman and Hassler (1995) and Waters (1992) suggested that this species may have been extirpated from the area, since Hodge located them in 1972 (Hodge 1973). Our findings indicate that the previous studies either failed to locate specimens of this species that were present, or that the species has since recolonized the area. Another plausible scenario is that the former studies failed to intercept the breeding season for this species, similar to the scenario that we encountered at Mallard Slough in 2013.

The *A. macrodactylum* records from the Ward Lake area on Revillagigedo Island are interesting (see photograph in Appendix Figure E.1). Prior to these records, the Sokolof Island (Stikine Region) records documented by Norman and Hassler in 1992 were the southernmost records for this species in the state. Our collections on Revillagigedo Island in 2010 were recently published as a geographical distribution record in the Herpetological Review (Ream 2013). Because of distinct differences in the Ward Lake phenotypes as compared with Stikine River specimens, and because of the Waters and others (1998) report on the introduction of *P. regilla* at the same site, we speculate that this species was likely introduced alongside of *P. regilla*, and that they originated from a population in the Columbia River region of Washington State. The individual that introduced the frogs admitted that there may have been one other type of amphibian egg mass in the bucket that he transported to Alaska (Waters and others 1998).

It is also interesting that we have not yet located a specimen of *A. gracile* in the Stikine region. Dana Waters was the 1st and only to describe this species in the area, and his observation of an egg mass is not associated with voucher material. The single egg mass at Twin Lakes Warm Springs was reportedly partially consumed and found on land near the water (Waters 1992). Adults can be difficult to find given the species' largely subterranean life history and no additional observations of this species have been made as part of this study, despite intensive effort. In addition, no records of this species have been made on the Canada portion of the Stikine River, despite recent inventories in the region (Slough 2013). We acknowledge that multispecies surveys are usually inefficient for locating rare species (Pellet and Schmidt 2005) and we recommend that species-specific methods be included in future sampling efforts in this region.

No reptiles were found in this study despite extensive searching for *Thamnophis sirtalis*. Anecdotal reports from biologists have suggested that this species was observed at Shakes Hot Springs in the 1970s, but this could not be validated. During our study, three residents of Petersburg reported *T. sirtalis* observations on the Stikine River, as well as on both Mitkof and Kupreanof Islands. No one was able to provide specimen vouchers or photographic evidence of these encounters. We did however receive photographic vouchers for deceased specimens of *Chelonia mydas* from Burnett Inlet on Etolin Island, and from Chapin Bay on Admiralty Island. We did not encounter sea turtles in our study.

6.5.4 Morphological Data

Many studies involving amphibians collect morphological measurements that are tangential to the research focus. These studies rarely report the specific methods used for these measurements, and for determining life stage and sex of collected individuals. It is additionally difficult to extrapolate mean morphological dimensions of amphibians in a population because these species exhibit indeterminate growth (Perrin and Sibley 1993) and because environmental conditions at various life stages can impact adult growth (Homan and others 2003). Still, there may be some value in making qualitative analyses of these data, as this may lead to subsequent focused research to better validate the findings.

Despite the caveats and our limited sample size for most species, our study did produce limited yet unexpected data on amphibian morphology in the Stikine Region. We found that the mean SVL and mass of adult amphibians in our study were frequently lower than that of other studies reporting morphology of these species further south (e.g. Adams and others 2005, Bartelt and Peterson 2000, Greene and Funk 2009, Pilliod and others 2002, Guttmann and others 1991, Pagnucco and others 2012, Janzen and Brodie 1989). For instance, we report the mean mass of adult male and female *T. granulosa* as 13.0g (n=75, s=3.0) and 10.1g (n=74, s=3.1), respectively. By averaging the subsample SVL means for *T. granulosa* reported in Janzen and Brodie (1989), that study suggests an adult male mean mass of 18.9g (n=88) and an adult female mean mass of 11.4g (n=23) from animals collected in Oregon. Olson and others (1986) reported population gradients in *A. boreas* sizes among elevations that varied with snow melt and spring onset, suggesting this size pattern was associated with active season length; similarly, amphibian size patterns may vary with active seasons that differ with latitude or local factors driving spring onset. Future studies of morphology across the range of these species may better elucidate the validity and extent of morphological variation. These studies should incorporate controls for specimen age and environmental conditions.

6.5.5 Future Work

Future research is warranted to account for detectability across sites and years, identify population trends, changes in habitat, distributional effects of climate change, and the importance of geothermic springs as winter refugia and breeding habitat in the North. Furthermore, given the logistical and financial restraints on research in remote regions of Alaska, local and traditional knowledge and citizen science initiatives should be explored as alternatives or supplements to traditional approaches for monitoring amphibians.

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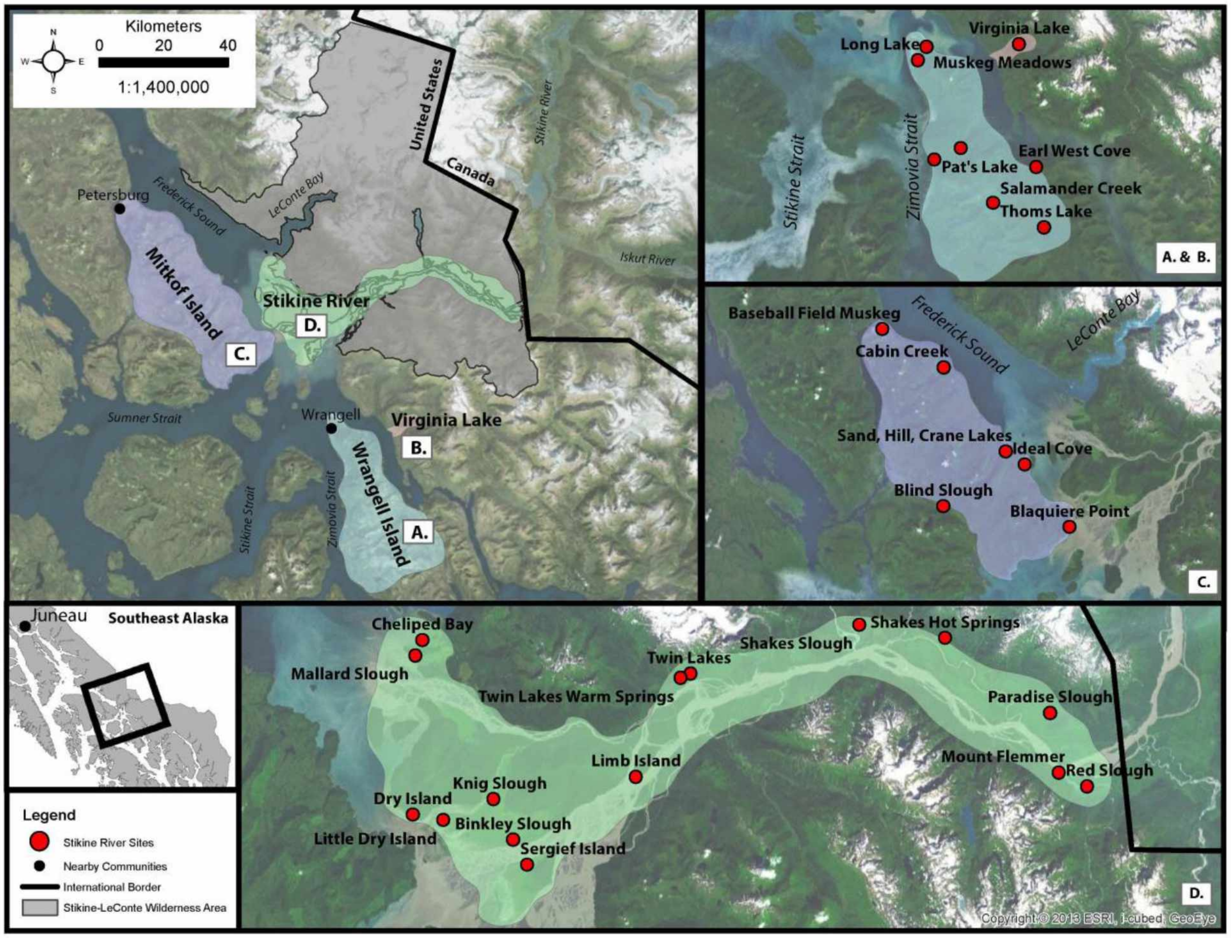

Figure 6.1. Map of general sampling regions and amphibian inventory field sites visited by Joshua Ream in 2010, 2012, and 2013 in southeast Alaska.

Table 6.1. Timing, methods, and locations of sampling for this study.

Sampling Dates	Sampling Type	General Sampling Areas
30 May 2010 - 15 July 2010	Opportunistic	Mitkof Island, Wrangell Island
16 May 2012 - 22 May 2012	Targeted	Mitkof Island, Stikine River
17 June 2012 - 20 June 2012	Targeted	Wrangell, Island
31 May 2013 - 8 June 2013	Targeted	Stikine River

Table 6.2. Newly reported amphibian occurrences recorded 2010-2013.

Abbreviations represent the following: *Anaxyrus boreas* (ANBO), *Lithobates sylvaticus* (LISY), *Rana luteiventris* (RALU), *Pseudacris regilla* (PSRE), *Taricha granulosa* (TAGR), *Ambystoma macrodactylum* (AMMA), and *Ambystoma gracile* (AMGR). *Ambystoma* spp. (AMSP) and *Rana* spp. (RASP) represent amphibians that were identified to genus and not to species. Cells indicate the number of amphibian observations obtained for each species in each year. Highlighted cells represent localities and species where far more amphibians were observed than were recorded as vouchers, usually including large numbers of egg masses and/or tadpoles. A dash (-) indicates unsampled sites. "Other" represents a compilation of opportunistic records from sites lacking project transects. Virginia Lake is located on the mainland in the Stikine Region but is designated separately due to its relative distance from the mouth of the Stikine River.

	2010									2012									2013									
	BUBO	RASY	RALU	PSRE	TAGR	AMMA	AMGR	AMSP	RASP	BUBO	RASY	RALU	PSRE	TAGR	AMMA	AMGR	AMSP	RASP	BUBO	RASY	RALU	PSRE	TAGR	AMMA	AMGR	AMSP	RASP	TOTAL
Mitkof Island	**1**	**0**	**0**	**0**	**15**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**18**
Baseball Field Muskeg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	-	-	-	-	-	-	-	-	-	**2**
Blaquiere Point	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	**0**
Blind Slough	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**0**
Cabin Creek	0	0	0	0	6	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**6**
Ideal Cove	0	0	0	0	7	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**7**
Sand, Hill, Crane Lakes	1	0	0	0	2	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3**
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	**0**
Stikine River	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**25**	**7**	**6**	**0**	**10**	**28**	**0**	**4**	**2**	**110**	**7**	**29**	**0**	**121**	**3**	**0**	**0**	**0**	**352**
Cheliped Bay	-	-	-	-	-	-	-	-	-	0	3	0	0	0	2	0	0	0	0	3	14	0	0	0	0	0	0	**22**
Dry Island	-	-	-	-	-	-	-	-	-	3	2	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	**5**
Farm Island	-	-	-	-	-	-	-	-	-	7	2	0	0	0	0	0	4	1	-	-	-	-	-	-	-	-	-	**14**
Binkley Slough	-	-	-	-	-	-	-	-	-	5	1	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	**6**
Knig Slough	-	-	-	-	-	-	-	-	-	2	1	0	0	0	0	0	4	1	-	-	-	-	-	-	-	-	-	**8**
Limb Island	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	**0**
Little Dry Island	-	-	-	-	-	-	-	-	-	2	0	0	0	0	1	0	0	0	-	-	-	-	-	-	-	-	-	**3**
Mallard Slough	-	-	-	-	-	-	-	-	-	0	0	0	0	0	24	0	0	1	0	2	0	0	0	2	0	0	0	**29**
Mount Flemmer	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**1**
Paradise Slough	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	0	6	0	10	1	0	0	0	**23**
Red Slough	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0	2	0	0	0	0	0	0	**3**
Sergief Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	54	0	0	0	0	0	0	0	0	**54**
Shakes Hot Springs	-	-	-	-	-	-	-	-	-	4	0	2	0	0	0	0	0	0	42	2	4	0	21	0	0	0	0	**75**
Shakes Slough	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	1	0	0	0	0	0	0	**1**
Twin Lakes	-	-	-	-	-	-	-	-	-	9	0	4	0	5	1	0	0	0	5	0	2	0	2	0	0	0	0	**28**
Spring	-	-	-	-	-	-	-	-	-	0	0	0	0	5	0	0	0	0	0	0	0	0	88	0	0	0	0	**93**
Other	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**1**

Table 6.2 continued…

	2010									2012									2013									
	BUBO	RASY	RALU	PSRE	TAGR	AMMA	AMGR	AMSP	RASP	BUBO	RASY	RALU	PSRE	TAGR	AMMA	AMGR	AMSP	RASP	BUBO	RASY	RALU	PSRE	TAGR	AMMA	AMGR	AMSP	RASP	TOTAL
Wrangell Island	**6**	**0**	**0**	**0**	**15**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**46**	**0**	**0**	**0**	**0**	-	-	-	-	-	-	-	-	-	**71**
Earl West Cove	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	**0**
Long Lake	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	**3**
Middle Ridge Cabin	0	0	0	0	2	0	0	0	0	0	0	0	0	11	0	0	0	0	-	-	-	-	-	-	-	-	-	**13**
Muskeg Meadows	-	-	-	-	-	-	-	-	-	4	0	0	0	4	0	0	0	0	-	-	-	-	-	-	-	-	-	**8**
Pat's Lake	1	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	-	-	-	-	-	-	-	-	-	**11**
Salamander Creek	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	**1**
Thoms Lake	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3**
Wrangell Reservoir	0	0	0	0	6	0	0	0	0	0	0	0	0	21	0	0	0	0	-	-	-	-	-	-	-	-	-	**27**
Other	2	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	**5**
Virginia Lake*	1	0	0	0	12	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**13**
OTHER	**2**	**0**	**0**	**2**	**4**	**4**	**0**	**0**	**0**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**12**
Revillagigedo Island	**0**	**0**	**0**	**2**	**0**	**4**	**0**	**0**	**0**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**6**
Ward Lake	0	0	0	2	0	4	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**6**
Haines	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2**
Mud Bay	2	0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2**
Prince of Wales Island	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**4**
Klawock	0	0	0	0	4	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**4**
TOTAL	**10**	**0**	**0**	**2**	**46**	**4**	**0**	**0**	**0**	**29**	**7**	**6**	**0**	**56**	**28**	**0**	**4**	**4**	**110**	**7**	**29**	**0**	**121**	**3**	**0**	**0**	**0**	**466**

Table 6.3. Stikine Region amphibian observations over time.

Sites visited by other authors on Mitkof Island, Wrangell Island, or the Stikine River but not specifically listed are reported as “Other” under the respective category. Abbreviations represent the following: *Anaxyrus boreas* (ANBO), *Lithobates sylvaticus*(LISY), *Rana luteiventris* (RALU), *Ambystoma macrodactylum* (AMMA), *Ambystoma gracile* (AMGR), and *Taricha granulosa* (TAGR). “B” indicates breeding sites where amphibians were observed as eggs, tadpoles/larvae, amplecting pairs, or chorusing. “Y” indicates sites where amphibians were observed but there was no evidence of breeding activity. “N” indicates sites where no amphibians were observed, “-“ indicates that the site was not sampled. Cells under “Other” represent the years in which at least one record is available from an alternative source. Bolded years represent observational / local knowledge data for which no voucher verification exists. Highlighted cells in yellow indicate amphibians for which voucher photographs were provided by members of the public to the author.

	BUBO				RASY				RALU				AMMA				AMGR				TAGR			
	This Study 2010-2013	Norman 1991-1992 [1]	Waters 1991 [2]	Other [3]	This Study 2010-2013	Norman 1991-1992 [1]	Waters 1991 [2]	Other [3]	This Study 2010-2013	Norman 1991-1992 [1]	Waters 1991 [2]	Other [3]	This Study 2010-2013	Norman 1991-1992 [1]	Waters 1991 [2]	Other [3]	This Study 2010-2013	Norman 1991-1992 [1]	Waters 1991 [2]	Other [3]	This Study 2010-2013	Norman 1991-1992 [1]	Waters 1991 [2]	Other [3]
Mitkof Island	Y	B	-	Y	N	N	-	Y	N	B	-	Y	N	N	-	N	N	N	-	N	Y	B	-	Y
Baseball Field Muskeg	N	N	-	-	N	N	-	-	N	B	-	-	N	N	-	-	N	N	-	-	N	N	-	-
Blaquiere Point	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-
Blind Slough	N	B	-	1976	N	N	-	-	N	N	-	-	N	N	-	-	N	N	-	-	N	N	-	-
Cabin Creek	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	Y	-	-	-
Ideal Cove	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	Y	-	-	-
Sand, Hill, Crane Lakes	Y	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	Y	-	-	-
Other	N	B	-	1941 **1976** **2004**	N	N	-	1974	N	B	-	1935 1974	N	N	-	-	N	N	-	-	N	B	-	1959 1997
Stikine River	B	B	B	Y	B	B	B	Y	B	B	B	Y	B	B	N	Y	N	N	B	N	B	B	B	N
Cheliped Bay	N	Y	Y	-	B	B	N	-	B	B	B	-	B	B	N	-	N	N	N	-	N	N	N	-
Dry Island	Y	-	B	-	B	-	Y	-	N	-	N	-	N	-	N	-	N	-	N	-	N	-	N	-
Farm Island	B	B	N	-	B	B	N	-	N	B	N	-	N	B	N	**1976**	N	N	N	-	N	N	N	-
Binkley Slough	B	B	N	-	B	B	N	-	N	B	N	-	N	B	N	-	N	N	N	-	N	N	N	-
Knig Slough	B	-	N	-	Y	-	N	-	N	-	N	-	N	-	N	-	N	-	N	-	N	-	N	-
Limb Island	N	-	N	-	N	-	N	-	N	-	N	-	N	-	N	-	N	-	N	-	N	-	N	-
Little Dry Island	Y	Y	N	-	N	N	N	-	N	N	N	-	Y	N	N	-	N	N	N	-	N	N	N	-
Mallard Slough	N	Y	N	-	B	B	B	-	N	B	B	-	B	B	N	-	N	N	N	-	N	N	N	-
Mount Flemmer	Y	N	Y	**2002**	N	N	N	-	N	N	N	-	N	N	N	-	N	N	N	-	N	N	N	-
Paradise Slough	Y	-	N	-	N	-	N	-	Y	-	N	-	Y	-	N	-	N	-	N	-	Y	-	Y	-
Red Slough	Y	Y	N	-	N	N	N	-	Y	N	N	-	N	N	N	-	N	N	N	-	N	N	N	-
Sergief Island	B	N	B	1919	N	N	N	1919	N	N	Y	1919	N	N	N	-	N	N	N	-	N	N	N	-
Shakes Hot Springs	B	B	B	**1982**	Y	Y	N	1973	B	B	Y	-	N	N	N	-	N	N	N	-	B	B	N	-
Shakes Slough	N	N	N	-	N	N	N	-	Y	N	Y	-	N	N	N	-	N	N	N	-	N	N	N	-

Table 6.3 continued…

	BUBO				RASY				RALU				AMMA				AMGR				TAGR			
	This Study 2010-2013	Norman 1991-1992 [1]	Waters 1991 [2]	Other [3]	This Study 2010-2013	Norman 1991-1992 [1]	Waters 1991 [2]	Other [3]	This Study 2010-2013	Norman 1991-1992 [1]	Waters 1991 [2]	Other [3]	This Study 2010-2013	Norman 1991-1992 [1]	Waters 1991 [2]	Other [3]	This Study 2010-2013	Norman 1991-1992 [1]	Waters 1991 [2]	Other [3]	This Study 2010-2013	Norman 1991-1992 [1]	Waters 1991 [2]	Other [3]
Twin Lakes	Y	B	B	1973	N	N	N	1973	B	B	B	1972	Y	N	N	1972 1973	N	N	B	-	Y	B	B	-
Twin Lakes Warm Spring	N	N	N	-	N	N	N	-	N	N	N	-	N	N	N	-	N	N	N	-	B	N	N	-
Other	B	N	B	1921 1942	N	N	Y	-	N	B	Y	1974	N	Y	N	-	N	N	N	-	N	N	Y	-
Wrangell Island	B	B	B	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	B	B	N	Y
Earl West Cove	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-
Long Lake	N	N	B	-	N	N	N	-	N	N	N	-	N	N	N	-	N	N	N	-	Y	B	N	-
Middle Ridge Cabin	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	B	-	-	-
Muskeg Meadows	B	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	B	-	-	-
Pat's Lake	Y	N	-	2003	N	N	-	-	N	N	-	-	N	N	-	-	N	N	-	-	B	B	-	-
Salamander Creek	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-
Thoms Lake	Y	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	Y	-	-	-
Wrangell Reservoir	N	-	-	**2002**	N	-	-	-	N	-	-	-	N	-	-	-	N	-	-	-	B	-	-	1973
Other	N	B	-	**1998** **2003**	N	N	-	-	N	N	-	-	N	N	-	-	N	N	-	-	Y	B	-	-
Virginia Lake	Y	-	Y	1957 1962	N	-	N	-	N	-	N	-	N	-	N	-	N	-	N	-	B	-	N	-

1. Data obtained through fieldwork conducted by Bradford Norman between 31 July 1991 and 20 August 1991, and between 28 March 1992 and 31 September 1992 (Norman and Hassler 1995). The 1991 voucher data from this author were obtained from records held in the following institutions and accessed through the HerpNET data portal (http://www.herpnet.org) on 20 December 2013: James R. Slater Museum (JSM). The author reportedly visited each site 1 to 2 times over both study years.

2. Data obtained through fieldwork conducted by Dana Waters between 23 May 1991 and 30 August 1991 (Waters 1992). All sites were visited 1 to 2 times during the study period with the exception of Twin Lakes (visited 6 times) and Shakes' Hot Springs (visited 3 times).

3. Data obtained through the Alaska Natural Heritage Program's (ANHP) Animal Data Portal (http://aknhp.uaa.alaska.edu), the HerpNET data portal, and the Tongass Historical Society Museum (THSM). The ANHP data was provided by that entity for the Stikine Region on 18 April 2012 and includes voucher data from records held at the following institutions: Texas Memorial Museum, University of Alaska Museum of the North (UAM), Auke Bay Laboratory (ABL), and the University Of Michigan Museum Of Zoology. All specimens held by ABL have since been transferred to UAM. All bolded data was provided by ANHP and represents local knowledge reports documented by R. Carstensen of Discovery Southeast as part of a larger study (Carstensen and others 2003). Only records listed as "medium" or "high" confidence were included. Additional records were derived from vouchers held in the following institutions and accessed through the HerpNET data portal (http://www.herpnet.org) on 20 December 2013: JSM, UAM, Museum of Vertebrate Zoology at Berkeley (MVZ), Los Angeles County Museum of Natural History (LACM), Texas Cooperative Wildlife Collection (TWC), and the Smithsonian National Museum of Natural History (USNM). Data from Parker Robert Hodge Historical Collection was provided by THSM. This collection has been transferred from THSM to ABL and finally to UAM.

Table 6.4. Morphometric measurements of adult amphibians recorded in the Stikine Region by Joshua Ream (2010-2013).

A "-"indicates that the morphometric measurement either doesn't apply to the species, too few records were obtained to provide the respective value, and or sexing confidence was low. Abbreviations represent the following: *Ambystoma macrodactylum* (AMMA), *Rana luteiventris* (RALU), *Taricha granulosa* (TAGR), *Lithobates sylvaticus* (LISY), and *Anaxyrus boreas* (ANBO).

	Mass					SVL					Tail Length				
	n	Mean (g)	Min. (g)	Max. (g)	SD	n	Mean (mm)	Min. (mm)	Max. (mm)	SD	n	Mean (mm)	Min. (mm)	Max. (mm)	SD
ANBO	**55**	**43.6**	**18.0**	**80.9**	**13.7**	**56**	**70**	**31**	**92**	**10.1**	**-**	**-**	**-**	**-**	**-**
Male	26	39.3	23.6	52.3	8.0	26	67	62	75	3.9	-	-	-	-	-
Female	19	51.8	32.4	70.1	11.7	20	73	31	92	13.0	-	-	-	-	-
RALU	**11**	**19.9**	**7.2**	**27.2**	**6.1**	**15**	**56**	**35**	**70**	**9.3**	**-**	**-**	**-**	**-**	**-**
Male	5	20.8	11.2	27.2	5.9	6	60	51	65	5.1	-	-	-	-	-
Female	4	20.6	15.9	24.6	3.8	5	59	54	70	6.5	-	-	-	-	-
LISY	**3**	**10.2**	**8.1**	**12.1**	**2.0**	**8**	**50**	**44**	**56**	**4.1**	**-**	**-**	**-**	**-**	**-**
Male	-	-	-	-	-	3	47	44	48	2.1	-	-	-	-	-
Female	-	-	-	-	-	2	54	52	56	2.8	-	-	-	-	-
AMMA	**23**	**3.5**	**1.7**	**8.4**	**1.6**	**25**	**49**	**37**	**96**	**12.0**	**25**	**48**	**31**	**82**	**11.3**
Male	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Female	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TAGR	**184**	**10.9**	**3.6**	**20.0**	**3.5**	**189**	**65**	**46**	**85**	**7.6**	**176**	**88**	**45**	**122**	**15.7**
Male	75	13.0	7.7	20.0	3.0	77	69	56	85	6.0	77	99	68	122	11.5
Female	74	10.1	4.4	18.6	3.1	75	61	46.0	74.0	6.4	75	79	51	102	11.3

Chapter 7 General Conclusions

Ethnobiology is a field that draws from many traditions and intellectual lineages, "weaving the middle space between cultural and archaeological anthropology, biology, indigenous studies, pharmacology, nutrition, history and ecology, among other disciplines" (Wyndham et al., 2011). It has the potential for far-reaching influence in many applied and academic settings (Nabhan, 2009) while simultaneously negotiating the spaces between epistemologies and ways of knowing the world (Wyndham et al., 2011). There is currently a push for the science to include more "applied" research and as Wolverton (2013) suggests, "ethnobiologists need to do nothing more than redirect relevant nature of 'knowing about human-environment relationships' already central to the field toward various disciplines concerned with conservation science and environmental studies."

This dissertation helps to advance the interdisciplinary and applied nature of the contemporary fifth stage of Ethnobiology. Beginning with chapter two a multitude of methods were used to access local and traditional knowledge of amphibians observed throughout participant lifetimes. Chapter three explores the use of one of these methods, the mailed survey instrument, to gauge the availability of local herpetological knowledge as well as the nature and extent of human-amphibian interactions and associated perceptions. Chapters four and five explore the use of citizen science, educational programs, and cross-team learning techniques to document faunal occurrence, distribution and life histories on local landscapes. Finally, chapter six uses western science techniques to further understand local populations of herpetofauna and to complement the information obtained in the prior chapters.

This work is a pioneering approach to combining ethnobiological techniques within local knowledge, citizen science and cross-team learning methodologies. It has elicited an understanding of the ways in which the respondents know about, feel about, and interact with local amphibians in a community with a rich cultural interaction with these species. The research has also inspired a renewed or enhanced interest in herpetology and herpetological conservation in the region. Adding to these advances in ethnobiology and herpetology, the study highlights the importance of local Tlingit relationships to the frog and cultural knowledge relevant to the management and conservation of non-consumptive species.

Each component of this research was informed by the others and was developed in coordination with project partners. For example, local knowledge and the findings of historical herpetological inventories were combined to identify monitoring sites for this research. Cross-team learning and citizen science approaches often require a level of flexibility that is not always permitted under strict western science protocols. For instance, specific monitoring sites for citizen science programming were chosen based on accessibility, safety, and cost effectiveness. The lack of site randomization and the minimal surveying of sites lacking historical data prevent extrapolation of resulting knowledge to a Stikine-wide understanding of amphibian populations. Still, the study resulted in many important insights on local amphibians, served to educate both scientists and the general public, inspired the establishment of ongoing partnerships, and promoted herpetological conservation and awareness in the region.

This highly interdisciplinary research was effective in bringing together a diverse array of scientists and local knowledge holders to advance understanding of the natural world. Considering recent publications in the field of ethnobiology, this study is somewhat unique for two reasons. First, most ethnozoological studies have focused primarily on human relationships with species known to have consumptive values. Secondly, the ethnobiological literature has tended toward an evaluation of knowledge forms that are intergenerational as well as knowledge that is held among indigenous people, though ethnobiologists have never restricted their studies to these knowledge sources (Anderson, 2012).

The collaborative and cross-team learning methods of this project allowed for the incorporation of multiple data sources for the generation of population estimates in a data-limited situation. This project expands scientific knowledge of amphibian diversity, distribution, and population trends over time throughout Alaska, especially in proximity to the Stikine River region of the state. The project resulted in 3,645 amphibian observations between 2010 and 2015. When combined with historical amphibian inventories in this region, the data provides one of the most comprehensive datasets for amphibian assemblages in Alaska. In addition, the results of this study offers useful insights on the use of local and traditional knowledge (LTK) and citizen science as means of supplementing standard herpetological techniques in the acquisition of amphibian population data. Furthermore, the study was successful in documenting human-amphibian interactions and perceptions in the community of Wrangell.

I found that our collaborative approaches to research substantially increased data availability while enhancing conservation through public participation and education. A total of 2,320 amphibian observations were contributed by members of the public and citizen scientists over the course of this study. This represented thousands of individual amphibians considering that large numbers of eggs and tadpoles were recorded as a single observation. In addition to providing occurrence data for native and non-native amphibian species, the contributions also provide documentation of important breeding sites through observations of amplexis, egg masses, tadpoles, larvae and chorusing adults. Many observations were validated through photographic evidence or expert identification. Those records that are purely observational also provide important data that may warrant additional investigation, such as the presence of previously undocumented species at individual localities.

Both the LTK and the citizen science components of this study resulted in a large number of amphibian records, 1,151 observations and 1,169 observations respectively. A major benefit of the LTK approaches used is that data is collected opportunistically and that the researchers need not be physically present for some of these, such as with the mailed survey instrument or web site submission forms. Alternatively, the citizen science methods typically require some degree of physical presence by the researcher, but this provides for expert training, species identification, and record verification. These citizen science programs allow for more ground to be covered in smaller time frames at different times of year. Furthermore, citizen scientists can provide many additional eyes and ears for detecting amphibian presence as compared to the limited size of ordinary field research crews.

An added benefit to using unique citizen science programs to train novice researchers is the capacity for reciprocal contributions and the establishment of institutional partnerships. This project leveraged the resources of several partner organizations to meet shared goals and aspirations. By providing educational and professional training to a broad audience, this project further supported herpetological conservation. I believe that as a result of these efforts, the general public is better aware of local amphibians and the threats facing these populations.

Interestingly, this study found that many residents of Wrangell feel at least somewhat familiar with Alaska amphibians (45% of survey respondents), and this may be due to relatively frequent encounters with these species on local landscapes. The frequency of respondent encounters with individual amphibian species appears to be correlated with relative local abundance of those species and the distance to the nearest population. It is therefore reasonable that Boreal Toads and Rough-skinned Newts are observed most frequently by Wrangell residents, as these species occur more abundantly on Wrangell Island.

Many local knowledge observations of amphibians were clustered near wetland sites that receive considerable recreational visitation. These wetlands are frequently in areas easily accessible by air or boat and with some anthropogenic structure (e.g. boardwalks, boat docks, restrooms, public-use cabins). Contributors that reported repeated visits to these sites were often able to provide information on changes to amphibian populations over time and sometimes observed several life stages of one or more species. These observations assisted us in identifying important breeding habitats, some of which were visited in our traditional inventories. This does however present a bias toward sites that are frequently visited by the public; I did not randomly sample within the landscape. Additional studies should expand sampling in the region to include randomly chosen sites.

Our combined datasets provide considerable insights on herpetological assemblages in the Stikine River region of Alaska. I documented the presence of five native amphibian species in a variety of habitat types. I was unable to confirm the presence of a sixth species, *A. gracile*, or a snake of the genus *Thamnophis*, both of which were previously reported but remain unverified. One non-native species, *P. regilla*, was documented for the first time in Wrangell in 2014, though there is no evidence of the establishment of a viable population.

Knowledge of species distribution in the Stikine River region was greatly enhanced by this study. Local knowledge contributions expand this distributional data substantially. I caution that untrained members of the public are not always confident in their species identification, especially for uncommon species that may share similar characteristics with more common species. I believe that for the limited number of species present in this region, local contributors are able to provide relatively accurate identifications to at least the family level and usually to genus or species. Observations of uncommon or undocumented species warrant additional verification measures in future work.

Species verification for contributor observations was sometimes confirmed through photographic documentation. Several of these photographs represent the first records of a species at a site, including *A. macrodactylum* at Guerin Slough and both *R. luteiventris* and *P. regilla* on Wrangell Island (see photographs in Appendix Figures E.6, E.5, E.7). Our amphibian inventories also provided additional expert verification of reported species at several sites. These were compared with historical inventories to better understand population fluctuations over time.

This project's amphibian inventories also contributed substantial amounts of distributional data (1,325 observations) that was compared with local knowledge and citizen science contributions, as well as with historical literature. I identified the continued occupation of species at several sites (e.g. *A. macrodactylum* near Twin Lakes), new locality data (e.g. *A. macrodactylum* at Little Dry Island and Revillagigedo Island), as well as apparent declines of species at sites where they were previously reported as abundant. Declines at individual sites are particularly concerning at previously reported breeding sites where local knowledge further substantiates these observations. Two important examples are suspected declines of *R. luteiventris* at the Petersburg Baseball Field Muskegs, and *A. boreas* at Blind Slough, both sites on Mitkof Island.

An important benefit of utilizing local knowledge and citizen science is that these can provide observations throughout the year, whereas active inventories are typically of limited duration and during a single season. This is particularly important to consider in the Stikine River region where annual variations in climate and hydrological conditions coupled with spatial and phenological variations allow for limited insight on populations over short time frames. In one example, our inventories failed to document *A. macrodactylum* in the immediate vicinity of the Twin Lakes site in May and June (I did find the species in a nearby beaver pond system), though local observations of this species were made by several individuals in August of consecutive years.

Documenting the nature of human-amphibian interactions and the perceptions of residents toward amphibians was also an important component of this study. I found that human-amphibian interactions in the Stikine River region were frequent and that resident attitudes toward amphibians were generally positive. Most respondents in the mailed survey portion of this study indicated that they believe amphibians are important locally to both social and ecological systems. Given that emotional responses are correlated to the retention and articulation of ethnobiological information (Nolan et al., 2006), and that Wrangell residents seem to hold extensive herpetological knowledge, it is interesting to speculate as to the degree in which ethnoherpetological relationships have resulted from local indigenous relationships with amphibians.

Ethnoherpetological relationships among the Tlingit in Wrangell are deeply rooted and must be considered when exploring the nature and extent of local herpetological knowledge in this community. These relationships are complex, and have evolved substantially over time (Ream, unpublished data). I have found that strong ethnoherpetological relationships continue to influence Tlingit culture in Wrangell, and that the perceptions and values held by members of the Kiks.adi Clan can contribute substantially to the conservation and treatment of local amphibians. As with many indigenous peoples, respect is the fundamental basis for understanding human relationships with other animals (Nadasdy, 2006).

It is important to note that this project used cross-team learning approaches and as such, each entity was influenced by this learning. Ethnobiological relationships and the extent of herpetological knowledge of team members may have been modified by participation in this project. “I never knew that” and “I never considered that until now” were frequent statements by all team members. As the project progressed over time, many participants indicated that they began considering their relationships with amphibians more frequently, and documenting interactions with these species more intentionally. Participants also gained confidence in their ability to accurately identify amphibians at the species level, including among the various life stages of these species.

The cross-team learning approach also influenced researcher knowledge and perspectives on amphibians. The local knowledge pertaining to changes in amphibians populations over time and areas of potential concern for declining populations assisted us in establishing monitoring sites. The researchers also learned of the values attributed to local amphibians (and reptiles) and how this has played a role in local interactions with these species over time. Local political issues, such as concerns for mining development on the Canada side of the Stikine, led us to teaching about amphibians in the context of “canaries in the coal mine” but also to include water quality testing within the Stikine Long-term Amphibian Monitoring Program. Gaining a deeper understanding of the role of local amphibians as pets and educational aids also led us to develop program curricula surrounding these relationships, including ethical and ecological concerns related to these topic areas. Clearly, perceptions, attitudes, and approach to the topics were influenced by the input of all partners.

This study also found that residents of Wrangell occasionally bring local amphibians home as pets or to view temporarily in aquaria. These amphibians were sometimes released back into the wild, and not always at the immediate sites of capture. In addition, non-native amphibians and reptiles acquired as pets from other sources have sometimes been released into the wild. I feel that these actions are not unique to Wrangell, and conversations with residents elsewhere suggest that this may occur in other areas of the state.

During this study, residents reported sightings of Blue Spotted Salamanders (*Ambystoma laterale*) in Chugiak, Pacific Chorus Frogs (*Pseudacris regilla*) in Sitka, Wrangell and Anchorage, Red-legged Frogs (*Rana aurora*) in Anchorage, and Red-eared Slider Turtles (*Trachemys scripta*) in Anchorage and Wasilla (see photographs in Appendix Figures E.4:E9). In most cases, I found that non-native herpetofaunal releases were a result of a lack of understanding and not malicious in nature. To reduce the threat of invasive species and disease transmission to native amphibians, I made substantial effort to educate the public on these risks and on the responsible acquisition and care of herpetofaunal pets.

The frequency with which native amphibians are translocated and non-native amphibians (and reptiles) are released was certainly an important finding of this study. These human-amphibian interactions are often connected to education and the pet trade. While close interaction with animals is known to increase knowledge of and compassion for these species (Drews, 2002; Tomažič, 2011), a lack of understanding regarding translocations and introductions may be leading to major threats to Alaska's native herpetofauna (Chapter 3). Interestingly, several traditional Tlingit stories teach respect for anurans and dire consequences to those that bring harm to these animals (Swanton, 1908; McClellan, 1953; de Laguna, 1972; Emmons, 1991; Cruikshank, 1992, Ream and Carothers, 2016). Regarding captivity, it was traditionally believed that holding the crest animal of a clan in the opposite moiety was akin to keeping a slave (de Laguna, 1972). These teachings may continue to provide important conservation ethics and may be valuable in addressing concerns related to translocations and introductions.

Traditional Tlingit relationships with the frog were derived in both respect and fear toward the metaphysical power of the frog yek, or spirit, but also in spiritual relationships with ancestors that can communicate and interact through transcendence with crest animals (de Laguna, 1972; Dauenhauer and Dauenhauer, 1990). In fact, all animals were treated as kin, differing from humans only in form, and lacking the distinctness attributed to species by western cultures (Emmons, 1991). These values, many of which continue to be held by culture bearers, continue to inform the ethical and sustainable treatment of local species. Ethnozoological documentation of these relationships and changes over time is not only important to culture, but may also provide insight on the cultural value of non-consumptive species with social-ecological systems. These topics will be explored in-depth within a future manuscript outside of this dissertation; preliminary insights are documented in Chapter 2. Future studies may also explore if communities lacking these relationships hold similar perceptions, attitudes, and knowledge toward amphibians.

I contend that local knowledge and citizen science need not replace established biological methods, but may be particularly valuable where inventories cannot be undertaken due to external constraints. These methods can complement and support one another, and both have unique benefits and pitfalls. They may be combined to obtain the greatest breadth and depth of scientific knowledge, or be used individually in data-limited situations that necessitate baseline population data that may otherwise be unavailable. The value of utilizing collaborative approaches however extends far beyond the acquisition of data by enhancing stakeholder involvement in management and conservation. Furthermore, I assert that species that are typically referred to as “non-game” often hold ecological, cultural, recreational, educational, and intrinsic values that should be considered alongside of economic importance when funds are directed for wildlife research and management.

"Animals are more than things to be named or eaten. Animals are fellow creatures that inspire our imaginations, people are sacred stories, inhabit our most fervent nightmares, and provide us a mirror to contemplate who and what we are."

-Eugene Hunn (2012)

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APPENDIX A: Research protocol approval letters from the University of Alaska Fairbanks Institutional Review Board (IRB) and the Institutional Animal Care and Use Committee (IACUC).

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UNIVERSITY OF ALASKA FAIRBANKS

Institutional Review Board

909 N Koyukuk Dr. Suite 212, P.O. Box 757270, Fairbanks, Alaska 99775-7270

June 8, 2010

To: William Schneider, PhD
Principal Investigator

From: Bridget Watson
Research Integrity Administrator
Office of Research Integrity

Re: IRB Protocol Application

Thank you for submitting the IRB protocol application identified below. This protocol was determined to qualify for expedited review under federal regulations 45 CFR 46.110(F)(7). Therefore the review of your protocol application was done by representative members of the IRB. On behalf of the IRB, I am pleased to inform you that your protocol has been approved.

Protocol #:	10-21
Title:	*An Analysis of Traditional and Local Herpetological Knowledge in Alaska and the Pacific Northwest*
Level:	Expedited
Received:	April 14, 2010 (original)
Approved:	June 8, 2010

Approval expires: June 8, 2011

Renewal:	Continuing Review must be completed by June 8, 2011. **Note:** We recommend you submit all continuing review documents approximately one month prior to the due date to prevent delays in your research.

Any modification or change to this protocol must be approved by the IRB prior to implementation. Modification Request Forms are available on the IRB website (http://www.uaf.edu/irb/Forms.htm). Please contact the Office of Research Integrity if you have any questions regarding IRB policies or procedures.

UNIVERSITY OF ALASKA FAIRBANKS

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Institutional Animal Care and Use Committee

909 N Koyukuk Dr. Suite 212, P.O. Box 757270, Fairbanks, Alaska 99775-7270

May 12, 2010

To:	Andres Lopez Principal Investigator
From:	University of Alaska Fairbanks IACUC
Re:	[169003-2] Survey of Amphibians and Reptiles of Alaska and British Columbia

The IACUC has reviewed the Protocol referenced below by Full Committee Review and requires modifications and/or clarifications to the submitted materials. The IACUC has determined that your revised materials can be handled by designated member review rather than being deferred to the next committee meeting. No animal activities may be initiated until the IACUC has reviewed and approved your revised documents.

Received:	April 30, 2010
Reviewed:	May 11, 2010

Required Modifications/Clarifications:

1. Please clarify the number of species to be lethally collected and/or clipped per life stage; that is, adult and larval stages per collection site and justify the reason for numbers.
2. In euthanasia section of protocol, please provide justification for not using MS-222 for lethal collection. Please also provide specific details on euthanasia methods at each site and cleaning instruments between individuals/sites. If MS-222 is to be used, please provide method of disposal (dilute and pour on ground minimum of 50 yards from water source.)
3. On the Capture & Transport SOP, please provide euthanasia method for injured nontarget species. Ethanol is not acceptable.
4. Please clarify that outreach efforts performed by community residents will be by photo only, no handling.
5. Submit a copy of the ADF&G permit in IRBNet when available.

This action is recorded in the minutes from the IACUC meeting on May 6, 2010.

If you have any questions about how to submit the required information through IRBNet please contact the Office of Research Integrity for assistance (email fyori@uaf.edu or call x7800/x7832).

APPENDIX B: Person hours and adjusted amphibian observation totals for sites sampled under two or more programs.

Table B.1. Person hours and adjusted amphibian observation totals for sites sampled under two or more programs.

Program	Site	Year	Site Size (hectares)	Elapsed Time (minutes)	Person Minutes	Person Hours	Animals Observed[1]	Animals Observed / Person Hour	Animals Observed / Person Hour / Hectare	NOTES
AmphiBlitz	Petersburg Baseball Field Muskegs	2014	195.0	389	873	14.55	10	0.69	0.004	3 participants for 3 transects, 2 participants for 5 transects
CampPhibian	Chief Shakes Hot Springs	2015	2.5	70	490	8.17	112	13.71	5.483	9 participants for 2 transects, 2 partipants for 1 transect
CampPhibian	Twin Lakes	2014	110.0	555	4740	79.00	17	0.22	0.002	10 participants for 14 transects, 3 participants for 3 transects
CampPhibian	Twin Lakes	2015	110.0	435	3915	62.25	329	5.29	0.048	9 participants all 17 transects
Service Learning	Cheliped Bay	2015	34.0	178	1602	26.70	475	17.79	0.523	9 participants for all 2 transects
Service Learning	Mallard Slough	2014	76.0	336	3024	50.40	214	4.25	0.056	9 participants for all 3 transects
SLAMP	Cheliped Bay	2012	34.0	105	210	3.50	6	1.71	0.050	2 participants for all 2 transects
SLAMP	Cheliped Bay	2013	34.0	30	60	1.00	6	6.00	0.176	2 participants for all 1 transect
SLAMP	Chief Shakes Hot Springs	2012	2.5	210	420	7.00	6	0.86	0.343	2 participants for all 3 transects
SLAMP	Chief Shakes Hot Springs	2013	2.5	270	540	9.00	60	6.67	2.667	2 participants for all 3 transects
SLAMP	Chief Shakes Hot Springs	2014	2.5	300	600	10.00	33	3.30	1.320	2 participants for all 3 transects
SLAMP	Mallard Slough	2012	76.0	375	750	12.50	25	2.00	0.026	2 participants for all 3 transects
SLAMP	Mallard Slough	2013	76.0	375	750	12.50	4	0.32	0.004	2 participants for all 3 transects
SLAMP	Petersburg Baseball Field Muskegs	2012	195.0	120	240	4.00	2	0.50	0.003	2 participants in 4 transects
SLAMP	Twin Lakes	2012	110.0	240	480	8.00	19	2.38	0.022	2 participants for all 17 transects
SLAMP	Twin Lakes	2013	110.0	225	450	7.50	9	1.20	0.011	2 participants for all 17 transects
SLAMP	Twin Lakes	2014	110.0	240	480	8.00	22	2.75	0.025	2 participants for all 17 transects

[1] = Corrected to exclude animals caught in traps. Large numbers of tadpoles or egg masses counted as single observation.

APPENDIX C: Survey instrument mailed to all postal boxes in Wrangell, AK in February of 2012.

AMPHIBIANS IN SOUTHEAST ALASKA

This study aims to better understand amphibians in Southeast Alaska in order to promote improved management and conservation of these species. I hope to identify alternative methods for gathering this information through the use of community knowledge, indigenous knowledge, citizen science and service learning projects. We ask that you support this initiative by taking a few moments to fill out this survey to the best of your ability. We guarantee that your responses to our questions will remain anonymous and that they will not be legally incriminating. Completing the survey indicates that you have read and agree to the "Informed Consent Form" included with this document. I thank you for your time.

This research is part of a University of Alaska Fairbanks student's doctoral thesis and is funded through the Global Change Student Grant Competition.

AMPHIBIAN & LOCAL KNOWLEDGE

PLEASE ANSWER THE FOLLOWING QUESTIONS ABOUT YOUR HOUSEHOLD'S KNOWLEDGE OF AMPHIBIANS AND THE LOCAL ENVIRONMENT. YOU MAY REFER TO THE PICTURES ON **PAGE 5 AND 6** OF THIS DOCUMENT FOR COMMON NATIVE SPECIES FOUND IN YOUR REGION OF ALASKA. REMEMBER THAT AMPHIBIANS INCLUDE FROGS, TOADS, SALAMANDERS AND NEWTS.

K2 How familiar do you consider yourself with laws pertaining to amphibians?

(1-Very familiar) (2-Somewhat familiar) (3-Somewhat unfamiliar) (4-Very Unfamiliar)

K3. Do you view amphibians as an important component of the local ecological community?

(1-Yes) (2-No)

K4. Which, if any, of the following environmental changes have you seen along the Stikine River and its associated coastal islands in recent years? (Circle all that apply)

1 warmer summer temperatures
2 cooler summer temperatures
3 warmer winter temperatures
4 cooler winter temperatures
5 drying of ponds
6 growing of ponds (more water)
7 earlier ice break-ups
8 later ice break-ups

Other: ____

K5. To which human groups are local amphibians important? (Circle all that apply)

(1-Everyone) (2-Adults) (3-Children) (4-Teachers) (5-Alaska Natives) (6-Non-Natives) (7-No one)

K6. Do you feel that members of your household would be interested in citizen science and outreach programs that teach people about local amphibians and help managers to monitor their health and populations?

(1-Yes) (2-No)

AMPHIBIAN INTERACTIONS

PLEASE ANSWER THE FOLLOWING QUESTIONS ABOUT YOUR HOUSEHOLD'S INTERACTIONS WITH AMPHIBIANS ON THE LAND AND WATER NEAR YOUR COMMUNITY. YOU MAY REFER TO THE PICTURES ON **PAGE 5 AND 6** OF THIS DOCUMENT FOR COMMON NATIVE SPECIES FOUND IN YOUR REGION OF ALASKA. REMEMBER THAT AMPHIBIANS INCLUDE FROGS, TOADS, SALAMANDERS AND NEWTS.

I1. What is the your general attitude when you encounter amphibians on the LOCAL landscape?

1 Enjoyment
2 Excitement
3 Fear
4 Respect
5 Indifference

I2. How often do you see frogs and toads on the LOCAL landscape?

1 Frequently (5 or more times per year)
2 Occasionally (1-4 times per year)
3 Rarely (multiple years between sightings)
4 Never

I3. How has the frequency that you have personally seen frogs and toads on the LOCAL landscape changed over the course of your life?

1 I see more now than I have in the past
2 I see less now than I have in the past
3 I have not noticed a change in the frequency that I see frogs and toads

I4. If you chose answer 1 or 2 on the last question, which of the following do you think may have caused this?

1 I travel on local landscapes LESS frequently now than I have in the past.
2 I travel on local landscapes MORE frequently now than I have in the past
3 I am paying less attention to frogs and toads now than I have in the past
4 I am paying MORE attention to frogs and toads now than I have in the past
5 Frog and toad populations seem to be increasing
6 Frog and toad populations seem to be decreasing
7 OTHER: ____

I5. How often do you see newts and salamanders on the LOCAL landscape?

1 Frequently (5 or more times per year)
2 Occasionally (1-4 times per year)
3 Rarely (multiple years between sightings)
4 Never

I6. How has the frequency that you have personally seen newts and salamanders on the LOCAL landscape changed over the course of your life?

1 I see more now than I have in the past
2 I see less now than I have in the past
3 I have not noticed a change in the frequency that I see newts and salamanders

I7. If you chose answer 1 or 2 on the last question, which of the following do you think may have caused this?

1 I travel on local landscapes LESS frequently now than I have in the past.
2 I travel on local landscapes MORE frequently now than I have in the past
3 I am paying less attention to newts and salamanders now than I have in the past
4 I am paying MORE attention to newts and salamanders now than I have in the past
5 Newt and salamander populations seem to be increasing
6 Newt and salamander populations seem to be decreasing
7 OTHER: ____

I8. When you or members of your household encounter amphibians on the LOCAL landscape, how often do you handle them?

(1-Always) (2-Occasionally) (3-Seldom) (4-Never)

I9. Have you or members of your household ever looked specifically for local amphibians? (Circle all that apply)

(1-Frogs) (2-Toads) (3-Newts) (4-Salamanders) (5-No, we haven't looked for them)

I10. Have you or a member of your household ever moved WILD amphibians from one area to another, either intentionally or unintentionally?

(1-Yes) (2-No)

I11. How often do you think that humans in the region move amphibians from place to place?

(1-Frequently) (2-Occasionally) (3-Rarely) (4-Never)

I12. Have you or a member of your household ever brought a local WILD amphibian home as a pet or to view temporarily in captivity?

(1-Yes) (2-No)

I13. Have you or a member of your household ever brought local WILD tadpoles home to watch them change into frogs?

(1-Yes) (2-No)

I14. If you or a member of your household has ever had a WILD amphibian as a pet, what became of this/these animal(s)?

1 Eventually died

2 Released into the wild where it was ORIGINALLY captured.
LOCATION:______________________
3 Released into the wild at a site OTHER THAN where it was originally captured
LOCATION:______________________
4 Given away
5 Escaped into the wild near our home

I15. Have you or a member of your household ever bought, won, or been given a NON-NATIVE amphibian while living in or near Wrangell?

(1-Yes) (2-No)

If YES, where were the animals obtained?

1 Local Vendor
2 Vendor in Alaska
3 Vendor Outside Alaska
4 Online Vendor
5 Friend

If YES, when was the most recent time this has occurred?

1 Less than a year ago
2 One to five years ago
3 Greater than 5 years ago

If YES, what became of this/these NON-NATIVE animal(s)?

1 Eventually died
2 Released into the wild (Where specifically? __________________________)
3 Given away
5 Escaped into wild

NATIVE AMPHIBIANS OF ALASKA

Have you or members of your household seen these frogs locally?

(1-Yes) (2-No)

I16. 

Wood Frog

I17. 

Boreal (Western) Toad

Have you or members of your household seen these toads locally?

(1-Yes) (2-No)

If yes, WHERE specifically?

____

I18. 

Columbia Spotted Frog

Have you or members of your household seen these frogs locally?

(1-Yes) (2-No)

If yes, WHERE specifically?

____

I19. 

Rough-skinned Newt

Have you or members of your household seen these newts locally?

(1-Yes) (2-No)

If yes, WHERE specifically?

____

I20. 

Long-toed Salamander

Have you or members of your household seen these salamanders locally?

(1-Yes) (2-No)

If yes, WHERE specifically?

____

I21. 

Northwestern Salamander

Have you or members of your household seen these salamanders locally?

(1-Yes) (2-No)

If yes, WHERE specifically?

____

I22. On the next page are a map of the Stikine River Valley and a map of Wrangell Island and Vicinity. Please take a few moments to label the maps with the following letters based on your experiences with local amphibians. Remember to refer to the photographs on pages 5 and 6 if you need help determining the species. Any details that you provide here, no matter how insignificant they seem, can be very beneficial to the study of these animals.

W – places that I have seen Wood Frogs
B – places that I have seen Boreal Toads
C – places that I have seen Columbia Spotted Frogs

R – places that I have seen Rough-skinned Newts
L – places that I have seen Long-toed Salamanders
N – places that I have seen Northwestern Salamanders

F – places that I have seen frogs but I don't know what kind
S – places that I have seen salamanders or newts but I don't know what kind
X – places that I have seen frogs or salamanders that I know are not listed above

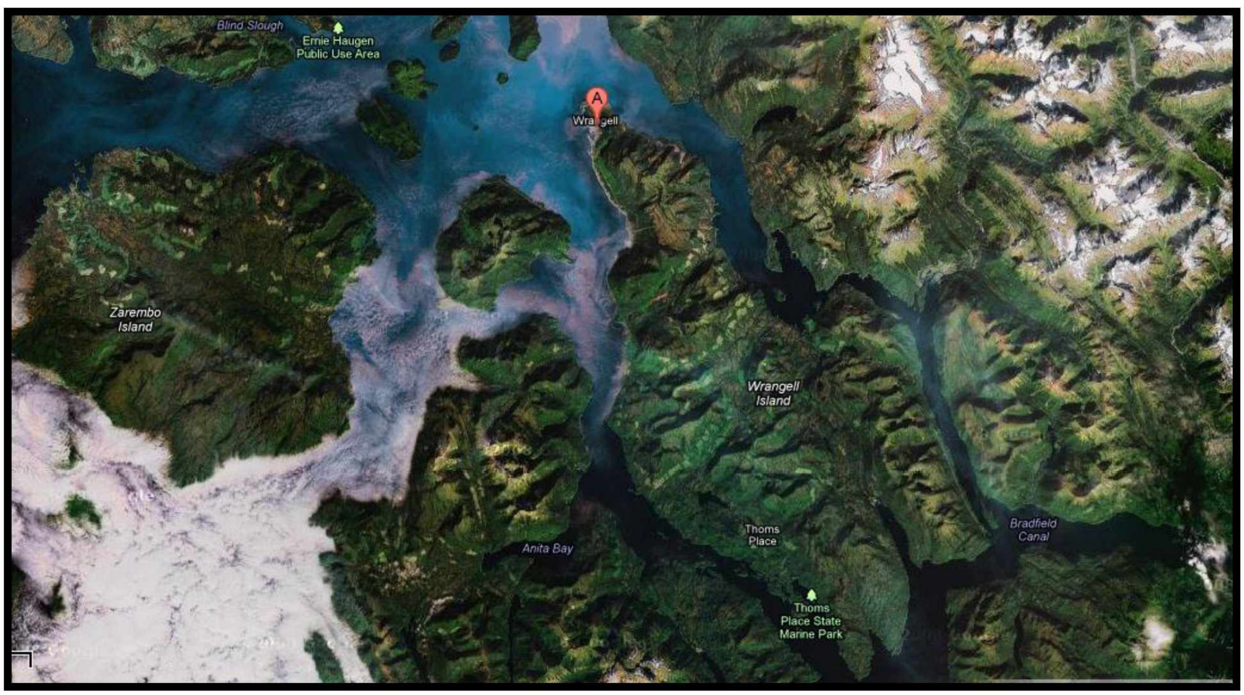
A – places that amphibians seem to occur abundantly
V – places that never seem to have amphibians
M – places that once had a lot of amphibians but don't seem to now
T – places that never seemed to have amphibians in the past but they do now

Q – places that I have heard frogs calling in the spring / summer
Z – places that I have seen tadpoles

PLEASE LABEL THE MAPS ON THE NEXT PAGE WITH THESE LETTERS!!!!!

Stikine River Valley

Wrangell Island and Vicinity



INFORMATION ABOUT YOU & YOUR HOUSEHOLD

PLEASE ANSWER THE FOLLOWING QUESTIONS ABOUT YOU AND YOUR HOUSEHOLD. THIS INFORMATION IS USED TO COMPARE OUR SURVEY RESPONDENTS AND THEIR COMMUNITIES. YOUR RESPONSES WILL BE KEPT CONFIDENTIAL AND SEPARATE FROM YOUR NAME. IF YOU FEEL COMFORTABLE PROVIDING CONTACT INFORMATION FOR US TO FOLLOW UP WITH YOU IN THE FUTURE, PLEASE CONSIDER DOING SO. THIS WILL ONLY BE USED FOR RESEARCH PURPOSES AND WILL NOT BE DISTRIBUTED.

H1. What is your Post Office Box number? ___________

H2. Does anyone else in your household have a Post Office Box in Wrangell, other than yours?

(1-Yes) (2-No) If Yes, Box # _________________

H3. How many people reside in your household? ___________

H4. How many children under the age of 18 reside in your household? __________

H5. Has anyone else in your household filled out one of these surveys?

(1-Yes) (2-No)

H6. What is your age? ____________

H7. What is your gender?

(1-Male) (2-Female)

H8. Do you own or have regular access to a boat for local travel?

(1-Yes) (2-No)

H9. Do you identify as Alaska Native?

(1-Yes) (2-No)

If yes, please answer any of the following that are known or apply to you:

Culture __________________________ Tribe _______________________________

Clan _____________________________ House Group _________________________

H10. Were you born and raised in or near Wrangell?

(1-Yes) (2-No)

If no, when did you move to Wrangell? _________________________

H11. Do you reside in or near Wrangell year round?

(1-Yes) (2-No)

H12. Do you reside in Wrangell year round?

(1-Yes) (1-No)

H13. How often do you travel along the Stikine River, nearby islands or local places other than Wrangell itself?

(1-Frequently) (2-Occasionally) (3-Rarely) (4-Never)

H14. How has the frequency that you travel along the Stikine River, nearby islands or local places other than Wrangell changed over time?

1 I travel MORE frequently to other local places now than I have in the past.
2 I travel LESS frequently to other local places now than I have in the past.
3 I travel to other local places about the same amount now as I have in the past.

H15. Do you seen or used the amphibian materials located in local forest service cabins?

(1-I saw them) (2-I wrote in them) (3-I have not seen them)

OPTIONAL INFORMATION:

Name ___________________________

Phone___________________________

Email____________________________

F1. Please use the space below and on the next page to provide any additional information regarding amphibians in the region that could assist managers in the conservation and study of these species.

THANK-YOU!

Please email Joshua Ream at jtream@alaska.edu if you would like more information or have any questions or suggestions. I would also love to see any amphibian pictures that you may have; please e-mail or return with your questionnaire any pictures we might be able to use! Please return your completed questionnaire in the enclosed envelope to:

10101 Thimble Berry Drive, Anchorage, AK 99515

APPENDIX D: Survey instrument mailed to a 25% sample of original survey instrument respondents in Wrangell, AK in February, 2013.

Amphibians of the Stikine

(A FOLLOW-UP SURVEY)

Long-toed Salamander (*Ambystoma macrodactylum*) photographed near Mallard Slough in 2012

This survey is a companion to the one that you submitted several months ago. I greatly appreciate your contributions to my research and I am excited to be making such great progress toward understanding the health of amphibian populations on the Stikine and in nearby localities. You were chosen to participate in this follow-up survey as part of a random sample of previous participants. I know that your time is valuable and I hope that this will take but a few moments to complete. I still guarantee that your responses to my questions will remain anonymous and that they will not be legally incriminating. Completing the survey indicates that you have read and agree to the "Informed Consent Form" included with this document. I thank you for your time. As always, I thank you for helping me to research Alaska's amphibians and human relationships with these species.

Also available in digital format at www.akherpsociety.org/wrangell2.htm. Please submit only one version.

This research is part of a University of Alaska Fairbanks (UAF) doctoral thesis and is being funded out-of-pocket by the student.

AMPHIBIAN & LOCAL KNOWLEDGE

PLEASE ANSWER THE FOLLOWING QUESTIONS ABOUT YOUR HOUSEHOLD'S KNOWLEDGE OF AMPHIBIANS AND THE LOCAL ENVIRONMENT. YOU MAY REFER TO THE PICTURES ON THE **LAST PAGE** OF THIS DOCUMENT FOR COMMON SPECIES FOUND IN YOUR REGION OF ALASKA. REMEMBER THAT AMPHIBIANS INCLUDE FROGS, TOADS, SALAMANDERS AND NEWTS.

F2. Do you feel that you are BETTER able to identify specific amphibian species after having participated in this study?

(1-Yes) (2-No)

F3. How confident do you feel in identifying local amphibian species by sight?

(1-Very Confident) (2-Somewhat Confident) (3-Somewhat Not Confident) (4- Not Confident)

F4. Do you feel that you would know a frog call if you heard it?

(1-Yes) (2-No)

F5. Have you ever heard a frog call locally?

(1-Yes) (2-No) (3-Not Sure)

If yes, where specifically? ____

If yes, when specifically? (season/month/year)____

F6. How many times did you visit the Stikine River in 2012?

(0) (1) (2) (3) (4) (5) (More Than 5)

F7. What was the average duration of each trip on the river in 2012?

(1 Day) (2-3 Days) (4-5 Days) (More Than 5 Days) (Not Applicable)

F8. What was / were the main purpose(s) of your trips on the river this year? (Circle All That Apply)

(1 Recreation) (2 Hunting) (3 Fishing) (4 Trapping) (5 Subsistence)

F9. How many of the following did you see locally in 2012? (Pictures on Last Page if Needed)

Wood Frog	(0)	(1)	(2)	(3)	(4)	(5 or More)
Boreal Toad	(0)	(1)	(2)	(3)	(4)	(5 or More)
Columbia Spotted Frog	(0)	(1)	(2)	(3)	(4)	(5 or More)
Rough-skinned Newt	(0)	(1)	(2)	(3)	(4)	(5 or More)
Long-toed Salamander	(0)	(1)	(2)	(3)	(4)	(5 or More)
Northwestern Salamander	(0)	(1)	(2)	(3)	(4)	(5 or More)
Unknown Frog or Toad	(0)	(1)	(2)	(3)	(4)	(5 or More)
Unknown Newt or Salamander	(0)	(1)	(2)	(3)	(4)	(5 or More)

F10. When and where did you see amphibians locally in 2012? (Be as Specific as Possible)

Wood Frog Month(s) ____________ Specific Location ________________________________

Boreal Toad Month(s) ____________ Specific Location ________________________________

Columbia Spotted Frog Month(s) ____________ Specific Location ________________________________

Rough-skinned Newt Month(s) ____________ Specific Location ________________________________

Long-toed Salamander Month(s) ____________ Specific Location ________________________________

Northwestern Salamander Month(s) ____________ Specific Location ________________________________

Unknown Frog or Toad Month(s) ____________ Specific Location ________________________________

Unknown Newt or Salamander Month(s) ____________ Specific Location ________________________________

F11. In what life stage were the local amphibians that you saw locally in 2012? (Circle All That Apply)

NOTE: Eggs are found in freshwater. Tadpoles (frogs and toads) live in the water and have tails. Larvae (salamanders and newts) live in the water and have gills. Juveniles are usually very small and stay near water. Adults are larger and can be found farther from water.

Wood Frog	(Eggs)	(Tadpoles or Larvae)	(Juveniles)	(Adults)	(Unknown)
Boreal Toad	(Eggs)	(Tadpoles or Larvae)	(Juveniles)	(Adults)	(Unknown)
Columbia Spotted Frog	(Eggs)	(Tadpoles or Larvae)	(Juveniles)	(Adults)	(Unknown)
Rough-skinned Newt	(Eggs)	(Tadpoles or Larvae)	(Juveniles)	(Adults)	(Unknown)
Long-toed Salamander	(Eggs)	(Tadpoles or Larvae)	(Juveniles)	(Adults)	(Unknown)
Northwestern Salamander	(Eggs)	(Tadpoles or Larvae)	(Juveniles)	(Adults)	(Unknown)
Unknown Frog or Toad	(Eggs)	(Tadpoles or Larvae)	(Juveniles)	(Adults)	(Unknown)
Unknown Newt or Salamander	(Eggs)	(Tadpoles or Larvae)	(Juveniles)	(Adults)	(Unknown)

F12. The Northwestern Salamander (pictured on last page) has not been confirmed in the Stikine Region. They are broad, dark brown in color and have large glands on the back of the head. Unlike Rough-skinned Newts, they do NOT have an orange / red stomach. Have you EVER seen one locally?

(1-Yes) (2-No)

If yes: Month(s) ___________ Year(s)____________ Specific Location____________________________________

F13. The Pacific Chorus Frog (pictured on last page) has not been confirmed in the Stikine Region. They are grey or bright green in color, have a black line through the eye and large pads at the end of their fingers. They have been introduced to Alaska in other areas. Have you EVER seen one locally?

(1-Yes) (2-No)

If yes: Month(s) ___________ Year(s)____________ Specific Location____________________________________

THANK-YOU!

Please email Joshua Ream at jtream@alaska.edu if you would like more information or have any questions or suggestions. I would also love to see any amphibian pictures that you may have; please e-mail or return with your questionnaire any pictures we might be able to use! Please return your completed questionnaire in the enclosed envelope to:

10101 Thimble Berry Drive, Anchorage, AK 99515

APPENDIX E: Selected project photographs of amphibians at sites where occurrence was previously undocumented.

Figure E.1. ***Ambystoma macrodactylum*** **captured near Ward Lake on Revillagigedo Island, Alaska on 19 July 2010.**

First *A. macrodactylum* verified on Revillagigedo Island. Ream collection ID 52; University of Alaska Museum ID UAM:Herp:367. Record published with following citation:

Ream, J. T. 2013. Geographic distribution. *Ambystoma macrodactylum*. Herpetological Review 44:4.

Figure E.2. ***Ambystoma macrodactylum*** **captured on Little Dry Island in proximity to the Stikine River, Alaska on 22 May 2012.**

First *A. macrodactylum* verified on Little Dry Island. Ream collection ID 139.

Figure E.3. ***Ambystoma macrodactylum*** **captured near Twin Lakes in proximity to the Stikine River, Alaska on 18 May 2012.**

Species previously presumed extirpated from area. Ream collection ID 110.

Figure E. 4. ***Ambystoma laterale*** **captured near Chugiak, Alaska by local resident in May, 2013.**

Reported to Joshua Ream on 9 May 2013. Purportedly released by neighbor in the fall of 2012 following original capture in Wisconsin. Specimen submitted to University of Alaska Museum but has not yet received a catalog number. Ream record ID M_Wright_1.

Figure E.5. *Anaxyrus boreas* and *Rana luteiventris* specimens photographed at Muskeg Meadows Golf Course near Wrangell, Alaska by local resident in summer of 2011.

Reported to Joshua Ream on 21 June 2012. First *R. luteiventris* verified on Wrangell Island. Ream record ID B_Smith_1.

Figure E.6. ***Ambystoma macrodactylum*** **photographed near Guerin Slough in proximity to the Stikine River, Alaska by local resident in summer of 2011.**

Reported to Joshua Ream on 18 July 2011. First *A. macrodactylum* verified near Guerin Slough. Ream record ID B_Schroeder_1.

Figure E.7. ***Pseudacris regilla*** **captured on a tote at a seafood processing plant in Wrangell, Alaska by local resident in June, 2014.**

Reported to Joshua Ream on 3 July 2014. First *P. regilla* verified on Wrangell Island. Ream record ID K_Bunness_1.

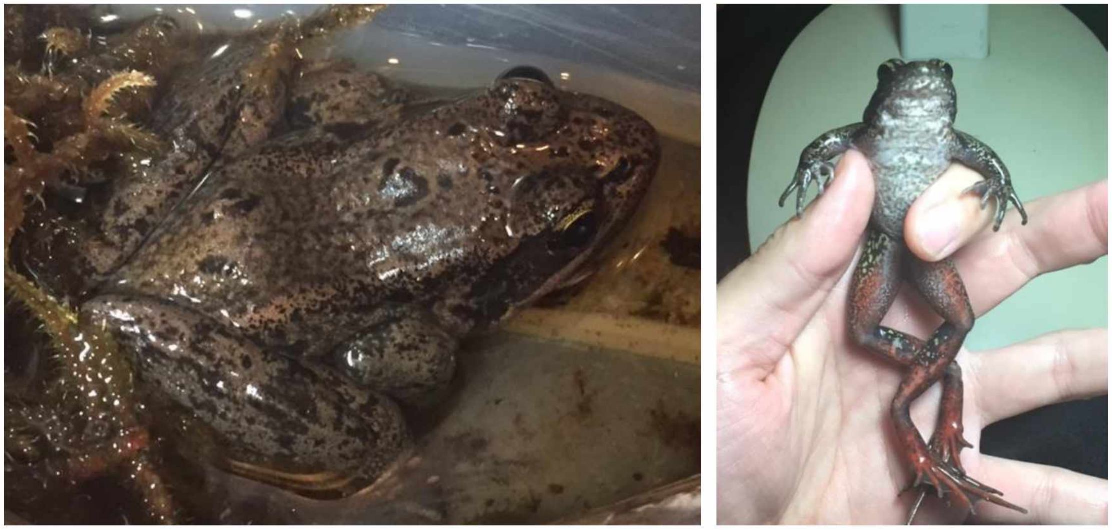


Figure E.8. ***Rana aurora*** **found at Bells Nursery in Anchorage, Alaska on 5 January 2015.** Presumed to have arrived in Alaska with a shipment of plants.

Figure E.9. *Trachemys scripta* reported to and captured by Joshua Ream on 4 August 2015.

Presumed to have been a released pet. Captured in Chester Creek, Anchorage, AK.

APPENDIX F: Abbreviated table of individual herpetofaunal observations made by Joshua Ream between 2010 and 2015, sorted by species, date and time.

Table F.1. Abbreviated table of individual herpetofaunal observations made by Joshua Ream between 2010 and 2015, sorted by species, date and time.

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location	State / Province	Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
63	*Ambystoma macrodactylum*	2012-05-16T10:10:00	Photograph	Mallard Slough	Stikine River	Alaska	56.711	-132.546	4.9	5.1	5.2	null	Adult	Observational	released
64	*Ambystoma macrodactylum*	2012-05-16T11:30:00	Photograph	Mallard Slough	Stikine River	Alaska	56.711	-132.546	2.6	4.2	3.9	null	Adult	Observational	released
65	*Ambystoma macrodactylum*	2012-05-16T11:45:00	Photograph	Mallard Slough	Stikine River	Alaska	56.709	-132.543	5.3	5.2	5.6	null	Adult	Observational	released
66	*Ambystoma macrodactylum*	2012-05-16T11:45:00	Photograph	Mallard Slough	Stikine River	Alaska	56.709	-132.543	8.4	6.6	6.0	null	Adult	Observational	released
70	*Ambystoma macrodactylum*	2012-05-16T13:25:00	Photograph	Mallard Slough	Stikine River	Alaska	56.710	-132.534	NA	null	null	null	Eggs	Observational	released
67	*Ambystoma macrodactylum*	2012-05-16T14:20:00	Photograph	Mallard Slough	Stikine River	Alaska	56.710	-132.543	NA	null	null	null	Eggs	Observational	released
68	*Ambystoma macrodactylum*	2012-05-16T14:25:00	Photograph	Mallard Slough	Stikine River	Alaska	56.710	-132.543	NA	null	null	null	Eggs	Observational	released
74	*Ambystoma macrodactylum*	2012-05-16T17:40:00	Photograph	Cheliped Bay	Stikine River	Alaska	56.715	-132.545	NA	null	null	null	Eggs	Observational	released
76	*Ambystoma macrodactylum*	2012-05-17T06:50:00	Photograph	Mallard Slough	Stikine River	Alaska	56.711	-132.546	2.4	4.6	3.6	null	Adult	Observational	released
77	*Ambystoma macrodactylum*	2012-05-17T07:20:00	Photograph	Mallard Slough	Stikine River	Alaska	56.712	-132.553	4.3	5.2	5.4	Female	Adult	Observational	released
78	*Ambystoma macrodactylum*	2012-05-17T07:38:00	Photograph	Mallard Slough	Stikine River	Alaska	56.712	-132.553	2.0	4.5	4.0	null	Adult	Observational	released
79	*Ambystoma macrodactylum*	2012-05-17T07:40:00	Photograph	Mallard Slough	Stikine River	Alaska	56.712	-132.553	3.6	4.7	3.8	null	Adult	Observational	released
80	*Ambystoma macrodactylum*	2012-05-17T07:46:00	Photograph	Mallard Slough	Stikine River	Alaska	56.712	-132.553	3.3	9.6	4.8	null	Adult	Observational	released
81	*Ambystoma macrodactylum*	2012-05-17T08:01:00	Photograph	Mallard Slough	Stikine River	Alaska	56.714	-132.556	3.2	4.1	3.7	null	Adult	Observational	released
82	*Ambystoma macrodactylum*	2012-05-17T08:28:00	Photograph	Mallard Slough	Stikine River	Alaska	56.715	-132.557	3.3	4.6	4.8	null	Adult	Observational	released
83	*Ambystoma macrodactylum*	2012-05-17T08:28:00	Photograph	Mallard Slough	Stikine River	Alaska	56.715	-132.557	2.6	4.2	4.4	null	Adult	Observational	released
84	*Ambystoma macrodactylum*	2012-05-17T08:28:00	Photograph	Mallard Slough	Stikine River	Alaska	56.715	-132.557	2.6	4.2	4.2	null	Adult	Observational	released
85	*Ambystoma macrodactylum*	2012-05-17T08:28:00	Photograph	Mallard Slough	Stikine River	Alaska	56.715	-132.557	2.7	4.7	4.4	null	Adult	Observational	released
86	*Ambystoma macrodactylum*	2012-05-17T08:28:00	Photograph	Mallard Slough	Stikine River	Alaska	56.715	-132.557	2.5	4.5	4.3	null	Adult	Observational	released
87	*Ambystoma macrodactylum*	2012-05-17T08:28:00	Photograph	Mallard Slough	Stikine River	Alaska	56.715	-132.557	2.2	3.7	3.9	null	Adult	Observational	released
88	*Ambystoma macrodactylum*	2012-05-17T08:28:00	Photograph	Mallard Slough	Stikine River	Alaska	56.715	-132.557	2.5	3.8	3.1	null	Adult	Observational	released
89	*Ambystoma macrodactylum*	2012-05-17T08:28:00	Photograph	Mallard Slough	Stikine River	Alaska	56.715	-132.557	1.7	4.0	3.8	null	Adult	Observational	released
90	*Ambystoma macrodactylum*	2012-05-17T08:28:00	Photograph	Mallard Slough	Stikine River	Alaska	56.715	-132.557	2.3	4.2	4.6	null	Adult	Observational	released
91	*Ambystoma macrodactylum*	2012-05-17T08:45:00	Photograph	Mallard Slough	Stikine River	Alaska	56.715	-132.557	2.6	4.2	4.4	null	Adult	Observational	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location	State / Province
92	*Ambystoma macrodactylum*	2012-05-17T08:45:00	Photograph	Mallard Slough	Stikine River	Alaska
72	*Ambystoma macrodactylum*	2012-05-17T09:40:00	Observation	Cheliped Bay	Stikine River	Alaska
110	*Ambystoma macrodactylum*	2012-05-18T12:11:00	Photograph	Twin Lakes	Stikine River	Alaska
139	*Ambystoma macrodactylum*	2012-05-22T14:55:00	Photograph	Little Dry Island	Stikine River	Alaska
234	*Ambystoma macrodactylum*	2013-06-02T07:06:00	Photograph	Paradise Slough	Stikine River	Alaska
223	*Ambystoma macrodactylum*	2013-06-07T21:30:00	Photograph	Mallard Slough	Stikine River	Alaska
224	*Ambystoma macrodactylum*	2013-06-07T21:40:00	Photograph	Mallard Slough	Stikine River	Alaska
528	*Ambystoma macrodactylum*	2014-05-19T08:37:00	Photograph	Barnes Lake	Stikine River	Alaska
529	*Ambystoma macrodactylum*	2014-05-19T08:45:00	Photograph	Barnes Lake	Stikine River	Alaska
539	*Ambystoma macrodactylum*	2014-05-19T09:27:00	Photograph	Barnes Lake	Stikine River	Alaska
628	*Ambystoma macrodactylum*	2014-09-08T12:58:00	Photograph	Mallard Slough	Stikine River	Alaska
624	*Ambystoma macrodactylum*	2014-09-08T17:34:00	Photograph	Mallard Slough	Stikine River	Alaska
623	*Ambystoma macrodactylum*	2014-09-08T17:56:00	Photograph	Mallard Slough	Stikine River	Alaska
619	*Ambystoma macrodactylum*	2014-09-09T12:14:00	Photograph	Cheliped Bay	Stikine River	Alaska
53	*Ambystoma macrodactylum*	2010-07-19T18:00:00	photograph	Frog Pond Trail	Revillagigedo Island	Alaska
54	*Ambystoma macrodactylum*	2010-07-19T18:00:00	photograph	Frog Pond Trail	Revillagigedo Island	Alaska
55	*Ambystoma macrodactylum*	2010-07-19T18:00:00	photograph	Frog Pond Trail	Revillagigedo Island	Alaska
57	*Ambystoma macrodactylum*	2010-07-20T10:15:00	photograph	Frog Pond Trail	Revillagigedo Island	Alaska
130	*AMBYSTOMA spp*	2012-05-22T06:30:00	Photograph	Farm Island	Stikine River	Alaska
134	*AMBYSTOMA spp*	2012-05-22T11:36:00	Photograph	Farm Island	Stikine River	Alaska
135	*AMBYSTOMA spp*	2012-05-22T11:45:00	Photograph	Farm Island	Stikine River	Alaska
136	*AMBYSTOMA spp*	2012-05-22T11:50:00	Observation	Farm Island	Stikine River	Alaska
1	*Anaxyrus boreas*	2010-05-27T12:00:00	photograph	Mud Bay Road	Haines	Alaska
2	*Anaxyrus boreas*	2010-05-27T12:00:00	photograph	Mud Bay Road	Haines	Alaska
5	*Anaxyrus boreas*	2010-05-31T13:30:00	photograph	Sand Hill Crane Lakes	Mitkof Island	Alaska
12	*Anaxyrus boreas*	2010-06-14T17:00:00	photograph	Thoms Lake	Wrangell Island	Alaska
13	*Anaxyrus boreas*	2010-06-14T17:00:00	photograph	Thoms Lake	Wrangell Island	Alaska
21	*Anaxyrus boreas*	2010-06-18T12:00:00	photograph	McCormick Creek	Wrangell Island	Alaska

Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
56.715	-132.557	-	null	null	null	Adult	Observational	released
56.715	-132.553	NA	null	null	null	Eggs	Observational	released
56.701	-132.253	4.8	5.6	6.9	null	Adult	Observational	released
56.620	-132.512	4.7	5.2	5.7	null	Metamorph	Observational	released
56.691	-131.931	5.5	6.1	8.2	Male	Adult	minnow trap	released
56.711	-132.546	null	4.6	5.1	Female	Adult	observation	released
56.711	-132.548	null	4.8	5.0	Female	Adult	observation	released
56.691	-131.931	8.0	7.1	9.2	Male	Adult	Minnow Trap	released
56.691	-131.931	8.0	6.3	7.8	Male	Adult	Minnow Trap	released
56.691	-131.931	8.0	7.0	9.7	Male	Adult	Minnow Trap	released
56.711	-132.546	7.0	6.0	6.3	Female	Adult	Hand	released
56.712	-132.551	5.0	5.7	5.5	Female	Adult	Hand	released
56.712	-132.551	2.0	3.5	3.6	null	Juvenile	Hand	released
56.715	-132.544	2.0	6.0	4.0	null	Juvenile	Hand	released
55.408	-131.704	4.6	6.0	6.8	male	adult	Observational	in collection
55.408	-131.704	5.0	6.0	5.8	male	adult	Observational	released
55.408	-131.704	6.7	6.3	6.0	female	adult	Observational	released
55.407	-131.701	3.1	4.8	5.0	female	adult	Observational	in collection
56.650	-132.453	-	null	null	null	Eggs	Observational	released
56.638	-132.461	-	null	null	null	Eggs	Observational	released
56.639	-132.461	-	null	null	null	Eggs	Observational	released
56.639	-132.460	-	null	null	null	Eggs	Observational	released
59.218	-135.451	2.0	null	null	unknown	metamorph	Observational	released
59.218	-135.451	1.6	null	null	unknown	metamorph	Observational	released
56.675	-132.684	42.4	8.0	null	male	adult	Observational	released
56.238	-132.259	2.1	3.0	null	unknown	juvenile	Observational	released
56.238	-132.259	1.8	3.0	null	unknown	juvenile	Observational	in collection
56.313	-132.343	18.0	9.0	null	female	adult	Observational	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location	State / Province
29	*Anaxyrus boreas*	2010-06-25T10:30:00	photograph	Virginia Lake Cabin	Virginia Lake	Alaska
37	*Anaxyrus boreas*	2010-07-02T22:30:00	photograph	Lower Salamander Creek	Wrangell Island	Alaska
46	*Anaxyrus boreas*	2010-07-11T22:40:00	photograph	Pats Lake	Wrangell Island	Alaska
47	*Anaxyrus boreas*	2010-07-12T15:00:00	photograph	Spur Road	Wrangell Island	Alaska
93	*Anaxyrus boreas*	2012-05-17T14:32:00	Photograph	Twin Lakes	Stikine River	Alaska
100	*Anaxyrus boreas*	2012-05-17T16:40:00	Photograph	Twin Lakes	Stikine River	Alaska
101	*Anaxyrus boreas*	2012-05-17T16:42:00	Photograph	Twin Lakes	Stikine River	Alaska
102	*Anaxyrus boreas*	2012-05-17T17:20:00	Photograph	Twin Lakes	Stikine River	Alaska
103	*Anaxyrus boreas*	2012-05-17T17:40:00	Photograph	Twin Lakes	Stikine River	Alaska
104	*Anaxyrus boreas*	2012-05-17T17:50:00	Photograph	Twin Lakes	Stikine River	Alaska
105	*Anaxyrus boreas*	2012-05-17T17:50:00	Photograph	Twin Lakes	Stikine River	Alaska
106	*Anaxyrus boreas*	2012-05-18T09:30:00	Photograph	Twin Lakes	Stikine River	Alaska
109	*Anaxyrus boreas*	2012-05-18T12:05:00	Observation	Twin Lakes	Stikine River	Alaska
117	*Anaxyrus boreas*	2012-05-18T18:45:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
118	*Anaxyrus boreas*	2012-05-18T18:45:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
121	*Anaxyrus boreas*	2012-05-19T12:30:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
122	*Anaxyrus boreas*	2012-05-19T12:30:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
124	*Anaxyrus boreas*	2012-05-20T12:50:00	Photograph	Farm Island	Stikine River	Alaska
125	*Anaxyrus boreas*	2012-05-20T12:50:00	Observation	Farm Island	Stikine River	Alaska
126	*Anaxyrus boreas*	2012-05-20T15:00:00	Photograph	Farm Island	Stikine River	Alaska
127	*Anaxyrus boreas*	2012-05-20T15:00:00	Photograph	Farm Island	Stikine River	Alaska
128	*Anaxyrus boreas*	2012-05-20T15:00:00	Photograph	Farm Island	Stikine River	Alaska
132	*Anaxyrus boreas*	2012-05-22T10:55:00	Photograph	Farm Island	Stikine River	Alaska
133	*Anaxyrus boreas*	2012-05-22T10:55:00	Photograph	Farm Island	Stikine River	Alaska
137	*Anaxyrus boreas*	2012-05-22T14:40:00	Photograph	Little Dry Island	Stikine River	Alaska
138	*Anaxyrus boreas*	2012-05-22T14:40:00	Photograph	Little Dry Island	Stikine River	Alaska
141	*Anaxyrus boreas*	2012-05-22T17:24:00	Observation	Dry Island	Stikine River	Alaska
142	*Anaxyrus boreas*	2012-05-22T17:28:00	Observation	Dry Island	Stikine River	Alaska
140	*Anaxyrus boreas*	2012-05-22T18:15:00	Photograph	Dry Island	Stikine River	Alaska
152	*Anaxyrus boreas*	2012-06-18T21:15:00	Photograph	null	Wrangell Island	Alaska
153	*Anaxyrus boreas*	2012-06-18T21:15:00	Photograph	null	Wrangell Island	Alaska
154	*Anaxyrus boreas*	2012-06-18T21:15:00	Observation	null	Wrangell Island	Alaska
156	*Anaxyrus boreas*	2012-06-18T21:35:00	Photograph	null	Wrangell Island	Alaska
197	*Anaxyrus boreas*	2013-05-31T19:20:00	Photograph	Mount Flemmer	Stikine River	Alaska
228	*Anaxyrus boreas*	2013-06-01T11:30:00	Photograph	Red Slough	Stikine River	Alaska
230	*Anaxyrus boreas*	2013-06-01T13:12:00	Photograph	Guerin Slough	Stikine River	Alaska
231	*Anaxyrus boreas*	2013-06-01T14:05:00	Photograph	Paradise Slough	Stikine River	Alaska
200	*Anaxyrus boreas*	2013-06-01T15:30:00	Photograph	Paradise Slough	Stikine River	Alaska
247	*Anaxyrus boreas*	2013-06-02T11:00:00	Photograph	Paradise Slough	Stikine River	Alaska
248	*Anaxyrus boreas*	2013-06-02T11:00:00	Photograph	Paradise Slough	Stikine River	Alaska
249	*Anaxyrus boreas*	2013-06-02T11:30:00	Photograph	Paradise Slough	Stikine River	Alaska
251	*Anaxyrus boreas*	2013-06-02T12:13:00	Photograph	Paradise Slough	Stikine River	Alaska

Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
56.482	-132.145	4.7	3.8	null	unknown	juvenile	Observational	released
56.303	-132.217	70.6	8.8	null	female	adult	Observational	in collection
56.351	-132.338	51.2	7.8	null	male	adult	Observational	in collection
null	null	80.9	9.0	null	male	adult	Observational	in collection
56.701	-132.278	26.0	6.4	null	null	Adult	Observational	released
56.699	-132.282	0.4	1.4	null	null	Metamorph	Observational	released
56.700	-132.282	1.1	1.8	null	null	Metamorph	Observational	released
56.697	-132.277	25.0	5.9	null	null	Adult	Observational	released
56.698	-132.276	35.4	6.9	null	Male	Adult	Observational	released
56.698	-132.276	26.1	6.1	null	null	Adult	Observational	released
56.698	-132.276	-	null	null	null	Adult	Observational	released
56.698	-132.266	29.2	5.9	null	null	Adult	Observational	released
56.701	-132.255	0.3	1.6	null	null	Metamorph	Observational	released
56.719	-132.015	40.4	7.3	null	Female	Adult	Observational	released
56.719	-132.015	13.7	5.0	null	Male	Juvenile	Observational	released
56.719	-132.015	-	null	null	null	Tadpoles	Observational	released
56.719	-132.015	-	null	null	null	Tadpoles	Observational	released
56.606	-132.455	-	null	null	null	Adults / Eggs	Observational	released
56.606	-132.455	42.5	7.0	null	Male	Adult	Observational	released
56.606	-132.455	30.1	6.3	null	Male	Adult	Observational	released
56.606	-132.455	33.0	6.2	null	Male	Adult	Observational	released
56.606	-132.455	>100	9.2	null	Female	Adult	Observational	released
56.632	-132.471	45.2	6.4	null	Male	Adult	Observational	released
56.637	-132.462	13.2	5.2	null	null	Juvenile	Observational	released
56.619	-132.513	0.5	1.7	null	null	Metamorph	Observational	released
56.619	-132.513	1.1	2.2	null	null	Metamorph	Observational	released
56.623	-132.532	-	null	null	null	Metamorph	Observational	released
56.623	-132.532	-	null	null	null	Metamorph	Observational	released
56.622	-132.533	1.1	2.4	null	null	Metamorph	Observational	released
56.477	-132.356	-	0.7	1.2	null	Tadpole	Observational	released
56.477	-132.356	-	1.0	1.2	null	Tadpole	Observational	released
56.477	-132.356	0.1	0.7	1.2	null	Tadpole	Observational	released
56.477	-132.356	66.5	7.2	null	Female	Adult	Observational	released
56.645	-131.902	36.8	6.8	null	Female	Adult	observation	released
56.639	-131.874	0.2	1.4	null	null	Metamorph	observation	released
56.666	-131.918	<2	1.6	null	null	Metamorph	observation	released
56.690	-131.931	29.9	6.5	null	Male	Adult	observation	released
56.691	-131.931	0.9	2.1	null	null	Juvenile	observation	released
56.697	-131.955	0.6	2.1	null	null	Metamorph	observation	released
56.697	-131.956	1.1	2.4	null	null	Metamorph	observation	released
56.697	-131.956	8.3	3.7	null	null	Juvenile	observation	released
56.696	-131.955	null	2.2	null	null	Subadult	observation	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location
258	*Anaxyrus boreas*	2013-06-02T18:16:00	Photograph	Shakes Hot Springs	Stikine River
280	*Anaxyrus boreas*	2013-06-03T10:20:00	Photograph	Shakes Hot Springs	Stikine River
281	*Anaxyrus boreas*	2013-06-03T10:20:00	Photograph	Shakes Hot Springs	Stikine River
282	*Anaxyrus boreas*	2013-06-03T10:20:00	Photograph	Shakes Hot Springs	Stikine River
283	*Anaxyrus boreas*	2013-06-03T10:20:00	Photograph	Shakes Hot Springs	Stikine River
284	*Anaxyrus boreas*	2013-06-03T10:20:00	Photograph	Shakes Hot Springs	Stikine River
285	*Anaxyrus boreas*	2013-06-03T10:20:00	Photograph	Shakes Hot Springs	Stikine River
286	*Anaxyrus boreas*	2013-06-03T10:20:00	Photograph	Shakes Hot Springs	Stikine River
287	*Anaxyrus boreas*	2013-06-03T10:20:00	Photograph	Shakes Hot Springs	Stikine River
288	*Anaxyrus boreas*	2013-06-03T10:20:00	Photograph	Shakes Hot Springs	Stikine River
289	*Anaxyrus boreas*	2013-06-03T10:20:00	Photograph	Shakes Hot Springs	Stikine River
290	*Anaxyrus boreas*	2013-06-03T10:20:00	Photograph	Shakes Hot Springs	Stikine River
291	*Anaxyrus boreas*	2013-06-03T11:37:00	Photograph	Shakes Hot Springs	Stikine River
292	*Anaxyrus boreas*	2013-06-03T11:37:00	Photograph	Shakes Hot Springs	Stikine River
293	*Anaxyrus boreas*	2013-06-03T11:37:00	Photograph	Shakes Hot Springs	Stikine River
294	*Anaxyrus boreas*	2013-06-03T11:37:00	Photograph	Shakes Hot Springs	Stikine River
295	*Anaxyrus boreas*	2013-06-03T11:37:00	Photograph	Shakes Hot Springs	Stikine River
242	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River
296	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River
297	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River
298	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River
299	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River
300	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River
301	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River

State / Province	Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
Alaska	56.718	-132.018	24.3	6.2	null	null	Adult	observation	released
Alaska	56.719	-132.015	0.7	1.6	2.0	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	1.1	3.7	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	0.7	3.5	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	0.9	3.4	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	0.8	3.8	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	0.9	3.4	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	1.0	3.7	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	0.9	3.7	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	0.8	3.4	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	1.0	3.6	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	0.7	3.5	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
Alaska	56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location	State / Province
302	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
303	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
304	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
305	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
306	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
307	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
308	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
309	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
310	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
311	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
312	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
313	*Anaxyrus boreas*	2013-06-03T11:51:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
314	*Anaxyrus boreas*	2013-06-03T11:54:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
315	*Anaxyrus boreas*	2013-06-03T11:54:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
316	*Anaxyrus boreas*	2013-06-03T11:54:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
317	*Anaxyrus boreas*	2013-06-03T11:54:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
318	*Anaxyrus boreas*	2013-06-03T12:10:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
319	*Anaxyrus boreas*	2013-06-03T12:10:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
321	*Anaxyrus boreas*	2013-06-03T18:45:00	Photograph	Twin Lakes	Stikine River	Alaska
322	*Anaxyrus boreas*	2013-06-04T11:00:00	Photograph	Twin Lakes	Stikine River	Alaska
325	*Anaxyrus boreas*	2013-06-04T13:16:00	Photograph	Twin Lakes	Stikine River	Alaska
327	*Anaxyrus boreas*	2013-06-04T14:09:00	Observation	Twin Lakes	Stikine River	Alaska
326	*Anaxyrus boreas*	2013-06-04T14:40:00	Photograph	Twin Lakes	Stikine River	Alaska
419	*Anaxyrus boreas*	2013-06-05T14:40:00	Photograph	Sergief Island	Stikine River	Alaska
420	*Anaxyrus boreas*	2013-06-05T14:59:00	Photograph	Sergief Island	Stikine River	Alaska
421	*Anaxyrus boreas*	2013-06-05T15:06:00	Photograph	Sergief Island	Stikine River	Alaska
422	*Anaxyrus boreas*	2013-06-05T15:15:00	Photograph	Sergief Island	Stikine River	Alaska
433	*Anaxyrus boreas*	2013-06-05T15:15:00	Photograph	Sergief Island	Stikine River	Alaska
423	*Anaxyrus boreas*	2013-06-05T16:08:00	Photograph	Sergief Island	Stikine River	Alaska
424	*Anaxyrus boreas*	2013-06-05T16:08:00	Photograph	Sergief Island	Stikine River	Alaska
425	*Anaxyrus boreas*	2013-06-05T16:08:00	Photograph	Sergief Island	Stikine River	Alaska

Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.015	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.016	null	null	null	null	Tadpole	minnow trap	released
56.719	-132.016	null	null	null	null	Tadpole	minnow trap	released
56.701	-132.247	30.6	6.8	null	Male	Adult	observation	released
56.701	-132.259	29.1	6.5	null	Male	Adult	observation	released
56.700	-132.267	23.6	6.2	null	Male	Adult	observation	released
56.700	-132.271	43.7	3.1	null	Female	Adult	observation	released
56.700	-132.269	58.8	7.7	null	Female	Adult	observation	released
56.599	-132.429	28.7	6.3	null	Male	Adult	observation	released
56.600	-132.427	41.9	7.5	null	Male	Adult	observation	released
56.599	-132.425	38.3	7.5	null	Male	Adult	observation	released
56.599	-132.423	0.9	2.3	null	null	Subadult	observation	released
56.598	-132.430	51.5	7.8	null	Female	Adult	observation	released
56.598	-132.430	null	null	null	null	Tadpole	observation	released
56.598	-132.430	null	null	null	null	Tadpole	observation	released
56.598	-132.430	null	null	null	null	Tadpole	observation	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location
426	*Anaxyrus boreas*	2013-06-05T16:08:00	Photograph	Sergief Island	Stikine River
427	*Anaxyrus boreas*	2013-06-05T16:08:00	Photograph	Sergief Island	Stikine River
428	*Anaxyrus boreas*	2013-06-05T16:08:00	Photograph	Sergief Island	Stikine River
429	*Anaxyrus boreas*	2013-06-05T16:08:00	Photograph	Sergief Island	Stikine River
430	*Anaxyrus boreas*	2013-06-05T16:08:00	Photograph	Sergief Island	Stikine River
431	*Anaxyrus boreas*	2013-06-05T16:08:00	Photograph	Sergief Island	Stikine River
432	*Anaxyrus boreas*	2013-06-05T16:08:00	Photograph	Sergief Island	Stikine River
444	*Anaxyrus boreas*	2013-06-05T16:33:00	Photograph	Sergief Island	Stikine River
389	*Anaxyrus boreas*	2013-06-05T16:41:00	Photograph	Sergief Island	Stikine River
434	*Anaxyrus boreas*	2013-06-05T16:51:00	Photograph	Sergief Island	Stikine River
435	*Anaxyrus boreas*	2013-06-05T17:01:00	Photograph	Sergief Island	Stikine River
436	*Anaxyrus boreas*	2013-06-05T17:01:00	Photograph	Sergief Island	Stikine River
437	*Anaxyrus boreas*	2013-06-05T17:01:00	Photograph	Sergief Island	Stikine River
438	*Anaxyrus boreas*	2013-06-05T17:01:00	Photograph	Sergief Island	Stikine River
439	*Anaxyrus boreas*	2013-06-06T08:52:00	Observation	Sergief Island	Stikine River
440	*Anaxyrus boreas*	2013-06-06T08:52:00	Observation	Sergief Island	Stikine River
445	*Anaxyrus boreas*	2013-06-06T09:20:00	Photograph	Sergief Island	Stikine River
441	*Anaxyrus boreas*	2013-06-06T09:30:00	Observation	Sergief Island	Stikine River
463	*Anaxyrus boreas*	2013-06-06T14:00:00	Photograph	Sergief Island	Stikine River
464	*Anaxyrus boreas*	2013-06-06T14:00:00	Photograph	Sergief Island	Stikine River
442	*Anaxyrus boreas*	2013-06-06T15:16:00	Photograph	Sergief Island	Stikine River
443	*Anaxyrus boreas*	2013-06-06T15:19:00	Photograph	Sergief Island	Stikine River
446	*Anaxyrus boreas*	2013-06-06T15:23:00	Photograph	Sergief Island	Stikine River
465	*Anaxyrus boreas*	2013-06-06T15:23:00	Photograph	Sergief Island	Stikine River
447	*Anaxyrus boreas*	2013-06-06T15:31:00	Photograph	Sergief Island	Stikine River
466	*Anaxyrus boreas*	2013-06-06T15:31:00	Photograph	Sergief Island	Stikine River
202	*Anaxyrus boreas*	2013-06-07T10:00:00	Photograph	Sergief Island	Stikine River
203	*Anaxyrus boreas*	2013-06-07T10:12:00	Photograph	Sergief Island	Stikine River
204	*Anaxyrus boreas*	2013-06-07T10:20:00	Photograph	Sergief Island	Stikine River
205	*Anaxyrus boreas*	2013-06-07T10:30:00	Photograph	Sergief Island	Stikine River
206	*Anaxyrus boreas*	2013-06-07T10:48:00	Photograph	Sergief Island	Stikine River
207	*Anaxyrus boreas*	2013-06-07T10:55:00	Photograph	Sergief Island	Stikine River
208	*Anaxyrus boreas*	2013-06-07T10:55:00	Photograph	Sergief Island	Stikine River
209	*Anaxyrus boreas*	2013-06-07T11:08:00	Photograph	Sergief Island	Stikine River
210	*Anaxyrus boreas*	2013-06-07T11:20:00	Photograph	Sergief Island	Stikine River
211	*Anaxyrus boreas*	2013-06-07T11:30:00	Observation	Sergief Island	Stikine River
212	*Anaxyrus boreas*	2013-06-07T11:35:00	Observation	Sergief Island	Stikine River
213	*Anaxyrus boreas*	2013-06-07T11:48:00	Photograph	Sergief Island	Stikine River
214	*Anaxyrus boreas*	2013-06-07T11:48:00	Photograph	Sergief Island	Stikine River
215	*Anaxyrus boreas*	2013-06-07T12:10:00	Photograph	Sergief Island	Stikine River
216	*Anaxyrus boreas*	2013-06-07T12:10:00	Photograph	Sergief Island	Stikine River
217	*Anaxyrus boreas*	2013-06-07T12:10:00	Photograph	Sergief Island	Stikine River
218	*Anaxyrus boreas*	2013-06-07T12:10:00	Photograph	Sergief Island	Stikine River
219	*Anaxyrus boreas*	2013-06-07T12:10:00	Photograph	Sergief Island	Stikine River
220	*Anaxyrus boreas*	2013-06-07T12:10:00	Photograph	Sergief Island	Stikine River
221	*Anaxyrus boreas*	2013-06-07T12:10:00	Photograph	Sergief Island	Stikine River
509	*Anaxyrus boreas*	2014-05-18T08:06:00	Photograph	Barnes Lake	Stikine River
512	*Anaxyrus boreas*	2014-05-18T10:46:00	Photograph	Barnes Lake	Stikine River
513	*Anaxyrus boreas*	2014-05-18T11:02:00	Photograph	Barnes Lake	Stikine River

State / Province	Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
Alaska	56.598	-132.430	null	null	null	null	Tadpole	observation	released
Alaska	56.598	-132.430	null	null	null	null	Tadpole	observation	released
Alaska	56.598	-132.430	null	null	null	null	Tadpole	observation	released
Alaska	56.598	-132.430	null	null	null	null	Tadpole	observation	released
Alaska	56.598	-132.430	null	null	null	null	Tadpole	observation	released
Alaska	56.598	-132.430	null	null	null	null	Tadpole	observation	released
Alaska	56.598	-132.430	null	null	null	null	Tadpole	observation	released
Alaska	56.597	-132.432	null	null	null	null	Tadpole	observation	released
Alaska	56.597	-132.433	null	null	null	null	Tadpole	observation	released
Alaska	56.598	-132.434	27.4	6.2	null	Male	Adult	observation	released
Alaska	56.598	-132.434	45.7	7.0	null	Female	Adult	observation	released
Alaska	56.598	-132.435	47.8	6.4	null	Male	Adult	observation	released
Alaska	56.598	-132.435	46.8	7.5	null	Female	Adult	observation	released
Alaska	56.598	-132.435	46.0	7.0	null	Male	Adult	observation	released
Alaska	56.597	-132.431	null	null	null	null	Tadpole	observation	released
Alaska	56.597	-132.432	null	null	null	null	Tadpole	observation	released
Alaska	56.591	-132.435	65.3	7.5	null	Female	Adult	observation	released
Alaska	56.590	-132.435	null	null	null	null	Tadpole	observation	released
Alaska	56.598	-132.432	35.8	7.5	null	Male	Adult	observation	released
Alaska	56.598	-132.433	60.2	8.0	null	Female	Adult	observation	released
Alaska	56.597	-132.440	49.6	7.6	null	Female	Adult	observation	released
Alaska	56.597	-132.440	43.6	7.1	null	Male	Adult	observation	released
Alaska	56.597	-132.440	null	null	null	null	Tadpole	observation	released
Alaska	56.597	-132.440	null	null	null	null	Tadpole	observation	released
Alaska	56.597	-132.441	null	null	null	null	Tadpole	observation	released
Alaska	56.597	-132.441	null	null	null	null	Tadpole	observation	released
Alaska	56.600	-132.426	67.4	9.0	null	Female	Adult	observation	released
Alaska	56.600	-132.426	44.4	6.4	null	Male	Adult	observation	released
Alaska	56.600	-132.425	48.2	7.0	null	Female	Adult	observation	released
Alaska	56.600	-132.425	67.8	7.8	null	Female	Adult	observation	released
Alaska	56.601	-132.422	70.1	8.8	null	Female	Adult	observation	released
Alaska	56.601	-132.421	54.4	6.4	null	Female	Adult	observation	released
Alaska	56.601	-132.421	46.5	6.8	null	Male	Adult	observation	released
Alaska	56.601	-132.421	54.1	8.1	null	Female	Adult	observation	released
Alaska	56.601	-132.419	39.0	7.0	null	Male	Adult	observation	released
Alaska	56.602	-132.419	32.4	6.3	null	Female	Adult	observation	released
Alaska	56.602	-132.419	35.4	6.2	null	Female	Adult	observation	released
Alaska	56.603	-132.417	49.1	7.5	null	Female	Adult	observation	released
Alaska	56.603	-132.417	1.2	2.2	null	null	Juvenile	observation	released
Alaska	56.603	-132.417	43.3	6.5	null	Male	Adult	observation	released
Alaska	56.603	-132.417	49.4	7.1	null	Male	Adult	observation	released
Alaska	56.603	-132.417	44.9	7.2	null	Male	Adult	observation	released
Alaska	56.603	-132.417	45.2	6.7	null	Male	Adult	observation	released
Alaska	56.603	-132.417	52.3	7.1	null	Male	Adult	observation	released
Alaska	56.603	-132.417	47.1	6.7	null	Male	Adult	observation	released
Alaska	56.603	-132.417	37.3	6.5	null	Male	Adult	observation	released
Alaska	56.670	-131.884	1.0	1.7	null	null	Metamorph	Hand	released
Alaska	56.673	-131.882	1.0	2.0	null	null	Metamorph	Hand	released
Alaska	56.673	-131.881	1.0	1.7	null	null	Metamorph	Hand	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location	State / Province
516	*Anaxyrus boreas*	2014-05-18T13:13:00	Photograph	Barnes Lake	Stikine River	Alaska
517	*Anaxyrus boreas*	2014-05-18T13:34:00	Photograph	Barnes Lake	Stikine River	Alaska
515	*Anaxyrus boreas*	2014-05-18T13:46:00	Photograph	Barnes Lake	Stikine River	Alaska
518	*Anaxyrus boreas*	2014-05-18T13:58:00	Photograph	Barnes Lake	Stikine River	Alaska
549	*Anaxyrus boreas*	2014-05-19T11:00:00	Photograph	Farm Island	Stikine River	Alaska
550	*Anaxyrus boreas*	2014-05-19T11:10:00	Photograph	Farm Island	Stikine River	Alaska
542	*Anaxyrus boreas*	2014-05-19T11:24:00	Photograph	Barnes Lake	Stikine River	Alaska
579	*Anaxyrus boreas*	2014-05-19T13:01:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
580	*Anaxyrus boreas*	2014-05-19T13:10:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
582	*Anaxyrus boreas*	2014-05-19T13:31:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
583	*Anaxyrus boreas*	2014-05-19T13:36:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
554	*Anaxyrus boreas*	2014-05-19T14:00:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
555	*Anaxyrus boreas*	2014-05-19T15:12:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
556	*Anaxyrus boreas*	2014-05-19T15:20:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
557	*Anaxyrus boreas*	2014-05-19T15:25:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
558	*Anaxyrus boreas*	2014-05-19T15:41:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
559	*Anaxyrus boreas*	2014-05-19T15:52:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
543	*Anaxyrus boreas*	2014-05-19T15:55:00	Photograph	Farm Island	Stikine River	Alaska
525	*Anaxyrus boreas*	2014-05-19T16:10:00	Observation	Barnes Lake	Stikine River	Alaska
544	*Anaxyrus boreas*	2014-05-19T16:25:00	Photograph	Farm Island	Stikine River	Alaska
547	*Anaxyrus boreas*	2014-05-19T16:55:00	Photograph	Farm Island	Stikine River	Alaska
587	*Anaxyrus boreas*	2014-05-20T13:00:00	Photograph	Twin Lakes	Stikine River	Alaska
588	*Anaxyrus boreas*	2014-05-20T13:10:00	Photograph	Twin Lakes	Stikine River	Alaska
589	*Anaxyrus boreas*	2014-05-20T13:48:00	Photograph	Twin Lakes	Stikine River	Alaska
591	*Anaxyrus boreas*	2014-05-21T08:22:00	Photograph	Twin Lakes	Stikine River	Alaska
592	*Anaxyrus boreas*	2014-05-21T08:30:00	Photograph	Twin Lakes	Stikine River	Alaska
593	*Anaxyrus boreas*	2014-05-21T09:06:00	Photograph	Twin Lakes	Stikine River	Alaska
594	*Anaxyrus boreas*	2014-05-21T09:20:00	Photograph	Twin Lakes	Stikine River	Alaska
595	*Anaxyrus boreas*	2014-05-21T09:39:00	Photograph	Twin Lakes	Stikine River	Alaska
596	*Anaxyrus boreas*	2014-05-21T09:50:00	Photograph	Twin Lakes	Stikine River	Alaska
597	*Anaxyrus boreas*	2014-06-06T10:33:00	Photograph	Twin Lakes	Stikine River	Alaska
598	*Anaxyrus boreas*	2014-06-06T11:00:00	Photograph	Twin Lakes	Stikine River	Alaska
599	*Anaxyrus boreas*	2014-06-06T11:10:00	Photograph	Twin Lakes	Stikine River	Alaska
607	*Anaxyrus boreas*	2014-06-06T12:37:00	Photograph	Twin Lakes	Stikine River	Alaska
603	*Anaxyrus boreas*	2014-06-06T13:20:00	Photograph	Twin Lakes	Stikine River	Alaska
604	*Anaxyrus boreas*	2014-06-06T13:32:00	Observation	Twin Lakes	Stikine River	Alaska
605	*Anaxyrus boreas*	2014-06-06T13:49:00	Photograph	Twin Lakes	Stikine River	Alaska
606	*Anaxyrus boreas*	2014-06-06T14:28:00	Photograph	Twin Lakes	Stikine River	Alaska
608	*Anaxyrus boreas*	2014-06-06T14:44:00	Photograph	Twin Lakes	Stikine River	Alaska

Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
56.670	-131.894	39.0	7.6	null	Male	Adult	Hand	released
56.690	-131.931	26.0	6.6	null	Male	Adult	Hand	released
56.670	-131.894	31.0	6.6	null	Male	Adult	Hand	released
56.669	-131.894	31.0	6.6	null	Male	Adult	Hand	released
56.606	-132.455	47.7	null	null	Male	Adult	Hand	released
56.606	-132.455	null	null	null	null	Eggs	Hand	released
56.674	-131.878	1.0	1.3	null	null	Juvenile	Hand	released
56.691	-131.931	0.0	1.6	10.2	null	Metamorph	Hand	released
56.720	-132.016	0.0	1.5	null	null	Metamorph	Hand	released
56.719	-132.016	1.0	1.2	1.8	null	Tadpole	Hand	released
56.719	-132.015	1.0	1.8	1.7	null	Tadpole	Hand	released
56.194	-132.015	1.6	2.4	null	null	Juvenile	Hand	released
56.719	-132.016	0.4	1.1	1.4	null	Tadpole	Hand	released
56.719	-132.015	2.0	2.8	null	null	Juvenile	Hand	released
56.719	-132.015	34.0	6.9	null	Male	Adult	Hand	released
56.719	-132.015	27.0	6.0	null	Male	Adult	Hand	released
56.719	-132.015	1.0	1.5	1.7	null	Tadpole	Hand	released
56.619	-132.405	7.7	4.1	null	null	Juvenile	Hand	released
56.690	-131.931	0.0	1.0	null	null	Metamorph	Hand	released
56.619	-132.407	5.6	4.1	null	null	Juvenile	Hand	released
56.619	-132.407	4.9	4.2	null	null	Juvenile	Hand	released
56.700	-132.266	1.5	2.4	null	null	Juvenile	Hand	released
56.700	-132.268	2.6	2.8	null	null	Juvenile	Hand	released
56.700	-132.268	1.2	2.2	null	null	Juvenile	Hand	released
56.700	-132.278	39.9	7.6	null	Male	Adult	Hand	released
56.700	-132.278	37.5	8.0	null	Male	Adult	Hand	released
56.698	-132.278	0.7	1.9	null	null	Juvenile	Hand	released
56.698	-132.278	35.4	6.4	null	Male	Adult	Hand	released
56.697	-132.277	40.7	7.0	null	Male	Adult	Hand	released
56.697	-132.278	36.9	7.2	null	Male	Adult	Hand	released
56.698	-132.267	6.0	4.3	0.0	null	Adult	Hand	released
56.698	-132.265	39.0	8.2	0.0	Male	Adult	Hand	released
56.699	-132.265	48.0	7.2	0.0	Female	Adult	Hand	released
56.700	-132.269	32.0	7.0	0.0	Male	Adult	Hand	released
56.700	-132.262	32.0	6.7	0.0	Male	Adult	Hand	released
56.700	-132.263	45.0	5.5	0.0	Female	Adult	Hand	released
56.706	-132.250	33.0	6.8	0.0	Female	Adult	Hand	released
56.701	-132.268	29.0	6.5	0.0	Male	Adult	Hand	released
56.700	-132.269	46.0	7.9	0.0	Male	Adult	Hand	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location
71	*Lithobates sylvaticus*	2012-05-16T17:40:00	Photograph	Cheliped Bay	Stikine River
73	*Lithobates sylvaticus*	2012-05-16T17:40:00	Photograph	Cheliped Bay	Stikine River
75	*Lithobates sylvaticus*	2012-05-16T18:40:00	Photograph	Cheliped Bay	Stikine River
123	*Lithobates sylvaticus*	2012-05-20T10:08:00	Photograph	Farm Island	Stikine River
131	*Lithobates sylvaticus*	2012-05-22T09:31:00	Photograph	Farm Island	Stikine River
143	*Lithobates sylvaticus*	2012-05-22T16:00:00	Photograph	Dry Island	Stikine River
144	*Lithobates sylvaticus*	2012-05-22T16:15:00	Observation	Dry Island	Stikine River
497	*Lithobates sylvaticus*	2012-6-22T00:00:00	Photograph	Point Woronzof	Anchorage
480	*Lithobates sylvaticus*	2012-7-25T00:00:00	Photograph	X-Lake	Talkeetna
253	*Lithobates sylvaticus*	2013-06-02T14:30:00	Photograph	Shakes Hot Springs	Stikine River
259	*Lithobates sylvaticus*	2013-06-02T18:54:00	Photograph	Shakes Hot Springs	Stikine River
448	*Lithobates sylvaticus*	2013-06-06T16:11:00	Photograph	Mallard Slough	Stikine River
453	*Lithobates sylvaticus*	2013-06-06T17:13:00	Observation	Cheliped Bay	Stikine River
456	*Lithobates sylvaticus*	2013-06-06T17:36:00	Observation	Cheliped Bay	Stikine River
462	*Lithobates sylvaticus*	2013-06-06T18:02:00	Observation	Cheliped Bay	Stikine River
222	*Lithobates sylvaticus*	2013-06-07T21:30:00	Photograph	Mallard Slough	Stikine River
476	*Lithobates sylvaticus*	2013-5-13T14:30:00	Photograph	Point Woronzof	Anchorage
477	*Lithobates sylvaticus*	2013-5-13T14:30:00	Photograph	Point Woronzof	Anchorage
478	*Lithobates sylvaticus*	2013-5-13T14:30:00	Photograph	Point Woronzof	Anchorage
479	*Lithobates sylvaticus*	2013-5-13T14:44:00	Audio	Point Woronzof	Anchorage
475	*Lithobates sylvaticus*	2013-5-15T00:00:00	Photograph	Far North Bicentennial Park	Anchorage
472	*Lithobates sylvaticus*	2013-5-1T00:00:00	Observation	Anchorage (City)	Anchorage
473	*Lithobates sylvaticus*	2013-5-25T17:20:00	Photograph	Far North Bicentennial Park	Anchorage
474	*Lithobates sylvaticus*	2013-5-25T17:20:00	Audio	Far North Bicentennial Park	Anchorage

State / Province	Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
Alaska	56.715	-132.545	8.111	4.4	null	Male	Adult	Observational	released
Alaska	56.715	-132.545	-	0.5	0.7	null	Tadpole	Observational	released
Alaska	56.715	-132.545	NA	null	null	null	Eggs	Observational	released
Alaska	56.614	-132.435	-	null	null	null	Tadpoles	Observational	released
Alaska	56.627	-132.458	12.1	5.2	null	null	Adult	Observational	released
Alaska	56.623	-132.549	10.4	4.9	null	null	Adult	Observational	released
Alaska	56.624	-132.549	-	null	null	null	Adult	Observational	released
Alaska	61.202	-150.020	null	null	null	null	Tadpole	observation	released
Alaska	62.296	-150.055	null	null	null	Male	Adult	observation	released
Alaska	56.719	-132.016	2.2	3.1	null	null	Subadult	observation	released
Alaska	56.718	-132.015	1.5	2.7	null	null	Subadult	observation	released
Alaska	56.709	-132.543	null	4.5	null	Male	Adult	observation	released
Alaska	56.716	-132.545	null	4.6	null	null	Adult	observation	released
Alaska	56.715	-132.547	null	5.6	null	Female	Adult	observation	released
Alaska	56.715	-132.551	null	4.8	null	Male	Adult	observation	released
Alaska	56.709	-132.543	null	5.2	null	Female	Adult	observation	released
Alaska	61.202	-150.020	null	null	null	Female	Adult	observation	released
Alaska	61.202	-150.020	null	null	null	Female	Adult	observation	released
Alaska	61.202	-150.020	null	null	null	Male	Adult	observation	released
Alaska	61.202	-150.020	null	null	null	Male	Adult	observation	released
Alaska	61.162	-149.743	null	null	null	Male	Adult	observation	released
Alaska	61.125	-149.859	null	null	null	Male	Adult	observation	released
Alaska	61.163	-149.743	null	null	null	null	Adult	observation	released
Alaska	61.163	-149.743	null	null	null	Male	Adult	observation	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location
548	*Lithobates sylvaticus*	2014-05-19T10:30:00	Observation	Farm Island	Stikine River
545	*Lithobates sylvaticus*	2014-05-19T16:30:00	Photograph	Farm Island	Stikine River
546	*Lithobates sylvaticus*	2014-05-19T16:35:00	Photograph	Farm Island	Stikine River
631	*Lithobates sylvaticus*	2014-09-08T14:40:00	Photograph	Mallard Slough	Stikine River
630	*Lithobates sylvaticus*	2014-09-08T15:13:00	Photograph	Mallard Slough	Stikine River
627	*Lithobates sylvaticus*	2014-09-08T18:28:00	Photograph	Mallard Slough	Stikine River
622	*Lithobates sylvaticus*	2014-09-09T11:11:00	Photograph	Cheliped Bay	Stikine River
504	*Phelsuma laticauda*	2013-12-1T00:00:00	Photograph	Kihei	Maui
499	*Plethodon glutinosus*	2010-8-15T00:00:00	Photograph	Pfeiffer Big Sur State Park	Rector
468	*Plethodon vehiculum*	2010-10-10T15:00:00	Photograph	Sasamat Lake	Vancouver
508	*Pseudacris crucifer*	2013-8-10T00:00:00	Photograph	Lutherlyn Camp	Prospect
62	*Pseudacris regilla*	2010-07-19T21:30:00	audio recording	Frog Pond Trail	Revillagigedo Island
56	*Pseudacris regilla*	2010-07-19T22:30:00	photograph	Frog Pond Trail	Revillagigedo Island
486	*Rana catesbeiana*	2013-8-5T00:00:00	Photograph	Wimmerton	Latrobe
488	*Rana catesbeiana*	2013-8-5T00:00:00	Photograph	Wimmerton	Latrobe
494	*Rana clamitans*	2013-8-10T00:00:00	Photograph	Lutherlyn Camp	Prospect
111	*Rana luteiventris*	2012-05-18T14:14:00	Photograph	Twin Lakes	Stikine River
112	*Rana luteiventris*	2012-05-18T14:14:00	Photograph	Twin Lakes	Stikine River
113	*Rana luteiventris*	2012-05-18T14:14:00	Photograph	Twin Lakes	Stikine River
114	*Rana luteiventris*	2012-05-18T14:14:00	Observation	Twin Lakes	Stikine River
119	*Rana luteiventris*	2012-05-18T18:45:00	Photograph	Shakes Hot Springs	Stikine River
120	*Rana luteiventris*	2012-05-19T10:00:00	Photograph	Shakes Hot Springs	Stikine River
201	*Rana luteiventris*	2013-06-01T11:13:00	Photograph	Red Slough	Stikine River
229	*Rana luteiventris*	2013-06-01T12:00:00	Photograph	Red Slough	Stikine River
198	*Rana luteiventris*	2013-06-01T13:59:00	Observation	Paradise Slough	Stikine River
199	*Rana luteiventris*	2013-06-01T15:00:00	Photograph	Paradise Slough	Stikine River
243	*Rana luteiventris*	2013-06-02T09:13:00	Photograph	Paradise Slough	Stikine River
244	*Rana luteiventris*	2013-06-02T09:55:00	Photograph	Paradise Slough	Stikine River
245	*Rana luteiventris*	2013-06-02T10:11:00	Photograph	Paradise Slough	Stikine River
250	*Rana luteiventris*	2013-06-02T11:30:00	Photograph	Paradise Slough	Stikine River
254	*Rana luteiventris*	2013-06-02T14:30:00	Photograph	Shakes Hot Springs	Stikine River
255	*Rana luteiventris*	2013-06-02T14:30:00	Photograph	Shakes Hot Springs	Stikine River
256	*Rana luteiventris*	2013-06-02T15:49:00	Photograph	Shakes Hot Springs	Stikine River

State / Province	Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
Alaska	56.612	-132.433	null	null	null	null	Juvenile	null	released
Alaska	56.619	-132.408	16.1	5.1	null	Male	Adult	Hand	released
Alaska	56.619	-132.407	8.1	4.5	null	Male	Adult	Hand	released
Alaska	56.710	-132.537	2.0	2.5	null	null	Juvenile	Hand	released
Alaska	56.710	-132.537	2.0	2.7	null	null	Juvenile	Hand	released
Alaska	56.712	-132.550	2.0	2.7	null	null	Juvenile	Hand	released
Alaska	56.715	-132.548	2.0	2.2	null	null	Juvenile	Hand	released
Hawaii	20.754	-156.457	null	null	null	null	Adult	observation	released
Pennsylvania	40.156	-79.227	null	null	null	null	Adult	observation	released
British Columbia	49.321	-122.894	1.8	4.8	null	Female	Adult	observation	released
Pennsylvania	40.884	-80.032	null	null	null	null	Juvenile	observation	released
Alaska	55.407	-131.705	null	null	null	male	adult	Observational	released
Alaska	55.407	-131.705	5.5	4.5	null	male	adult	Observational	in collection
Pennsylvania	40.288	-79.419	null	null	null	null	Adult	observation	released
Pennsylvania	40.288	-79.419	null	null	null	null	Tadpole	observation	released
Pennsylvania	40.881	-80.037	null	null	null	null	Adult	observation	released
Alaska	56.700	-132.264	19.4	6.1	null	Female	Adult	Observational	released
Alaska	56.700	-132.264	20.5	6.3	null	Male	Adult	Observational	released
Alaska	56.700	-132.264	23.5	6.2	null	Male	Adult	Observational	released
Alaska	56.700	-132.264	-	null	null	null	Eggs	Observational	released
Alaska	56.719	-132.015	22.5	5.7	null	Female	Adult	Observational	released
Alaska	56.719	-132.016	7.2	4.5	null	null	Adult	Observational	released
Alaska	56.638	-131.874	2.0	2.9	null	null	Juvenile	observation	released
Alaska	56.639	-131.876	27.2	6.5	null	Male	Adult	observation	released
Alaska	56.690	-131.931	null	null	null	null	Adult	observation	released
Alaska	56.690	-131.931	25.0	6.5	null	null	Adult	observation	released
Alaska	56.697	-131.942	16.5	5.5	null	null	Subadult	observation	released
Alaska	56.697	-131.944	7.1	4.0	null	null	Subadult	observation	released
Alaska	56.697	-131.944	2.3	2.8	null	null	Subadult	observation	released
Alaska	56.696	-131.955	2.6	3.2	null	null	Subadult	observation	released
Alaska	56.719	-132.016	2.8	3.2	null	null	Subadult	observation	released
Alaska	56.719	-132.016	1.6	2.7	null	null	Subadult	observation	released
Alaska	56.719	-132.015	11.2	5.1	null	Male	Adult	observation	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location
257	*Rana luteiventris*	2013-06-02T15:49:00	Photograph	Shakes Hot Springs	Stikine River
320	*Rana luteiventris*	2013-06-03T14:22:00	Photograph	Shakes Slough	Stikine River
323	*Rana luteiventris*	2013-06-04T11:34:00	Photograph	Twin Lakes	Stikine River
324	*Rana luteiventris*	2013-06-04T11:45:00	Photograph	Twin Lakes	Stikine River
449	*Rana luteiventris*	2013-06-06T16:47:00	Observation	Cheliped Bay	Stikine River
450	*Rana luteiventris*	2013-06-06T16:47:00	Observation	Cheliped Bay	Stikine River
451	*Rana luteiventris*	2013-06-06T16:58:00	Observation	Cheliped Bay	Stikine River
461	*Rana luteiventris*	2013-06-06T16:58:00	Observation	Cheliped Bay	Stikine River
452	*Rana luteiventris*	2013-06-06T17:06:00	Observation	Cheliped Bay	Stikine River
454	*Rana luteiventris*	2013-06-06T17:28:00	Observation	Cheliped Bay	Stikine River
455	*Rana luteiventris*	2013-06-06T17:28:00	Observation	Cheliped Bay	Stikine River
457	*Rana luteiventris*	2013-06-06T17:44:00	Observation	Cheliped Bay	Stikine River
458	*Rana luteiventris*	2013-06-06T17:53:00	Observation	Cheliped Bay	Stikine River
459	*Rana luteiventris*	2013-06-06T18:02:00	Observation	Cheliped Bay	Stikine River
460	*Rana luteiventris*	2013-06-06T18:12:00	Observation	Cheliped Bay	Stikine River
225	*Rana luteiventris*	2013-06-08T10:17:00	Photograph	Cheliped Bay	Stikine River
226	*Rana luteiventris*	2013-06-08T10:22:00	Photograph	Cheliped Bay	Stikine River
227	*Rana luteiventris*	2013-06-08T10:37:00	Photograph	Cheliped Bay	Stikine River
514	*Rana luteiventris*	2014-05-18T12:52:00	Photograph	Barnes Lake	Stikine River
526	*Rana luteiventris*	2014-05-19T08:28:00	Photograph	Barnes Lake	Stikine River
535	*Rana luteiventris*	2014-05-19T09:09:00	Photograph	Barnes Lake	Stikine River
581	*Rana luteiventris*	2014-05-19T13:20:00	Photograph	Shakes Hot Springs	Stikine River
584	*Rana luteiventris*	2014-05-19T13:43:00	Photograph	Shakes Hot Springs	Stikine River
553	*Rana luteiventris*	2014-05-19T13:55:00	Photograph	Shakes Hot Springs	Stikine River
560	*Rana luteiventris*	2014-05-19T16:18:00	Observation	Shakes Hot Springs	Stikine River
561	*Rana luteiventris*	2014-05-19T16:46:00	Photograph	Shakes Hot Springs	Stikine River
519	*Rana luteiventris*	2014-05-19T16:50:00	Photograph	Barnes Lake	Stikine River
520	*Rana luteiventris*	2014-05-19T16:59:00	Photograph	Barnes Lake	Stikine River
521	*Rana luteiventris*	2014-05-19T17:06:00	Photograph	Barnes Lake	Stikine River
563	*Rana luteiventris*	2014-05-19T17:13:00	Photograph	Shakes Hot Springs	Stikine River
522	*Rana luteiventris*	2014-05-19T17:21:00	Photograph	Barnes Lake	Stikine River
524	*Rana luteiventris*	2014-05-19T17:27:00	Photograph	Barnes Lake	Stikine River
523	*Rana luteiventris*	2014-05-19T17:40:00	Photograph	Barnes Lake	Stikine River
602	*Rana luteiventris*	2014-06-06T12:53:00	Photograph	Twin Lakes	Stikine River
635	*Rana luteiventris*	2014-09-07T14:53:00	Observation	Baseballfield Muskegs	Stikine River
636	*Rana luteiventris*	2014-09-07T14:53:00	Observation	Baseballfield Muskegs	Stikine River
632	*Rana luteiventris*	2014-09-07T15:00:00	Photograph	Baseballfield Muskegs	Stikine River
633	*Rana luteiventris*	2014-09-07T15:00:00	Observation	Baseballfield Muskegs	Stikine River

State / Province	Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
Alaska	56.719	-132.013	7.1	4.6	null	null	Subadult	observation	released
Alaska	56.731	-132.091	15.9	5.4	null	Female	Adult	observation	released
Alaska	56.700	-132.263	24.6	7.0	null	Female	Adult	observation	released
Alaska	56.700	-132.263	21.5	6.1	null	Male	Adult	observation	released
Alaska	56.715	-132.545	null	null	null	null	Subadult	observation	released
Alaska	56.715	-132.545	null	4.5	null	null	Adult	observation	released
Alaska	56.715	-132.545	null	3.0	null	null	Subadult	observation	released
Alaska	56.715	-132.545	null	3.0	null	null	Subadult	observation	released
Alaska	56.715	-132.545	null	null	null	null	Tadpole	observation	released
Alaska	56.715	-132.546	null	null	null	null	Tadpole	observation	released
Alaska	56.715	-132.546	null	null	null	null	Tadpole	observation	released
Alaska	56.715	-132.548	null	null	null	null	Tadpole	observation	released
Alaska	56.715	-132.549	null	3.5	null	null	Adult	observation	released
Alaska	56.715	-132.551	null	5.5	null	Female	Adult	observation	released
Alaska	56.715	-132.552	null	5.7	null	Male	Adult	observation	released
Alaska	56.716	-132.554	null	3.1	null	null	Tadpole	observation	released
Alaska	56.716	-132.554	null	3.1	null	null	Tadpole	minnow trap	released
Alaska	56.715	-132.553	null	5.0	null	null	Tadpole	minnow trap	released
Alaska	56.671	-131.889	4.0	3.6	null	null	Juvenile	Hand	released
Alaska	56.690	-131.931	18.0	5.7	null	Male	Adult	Hand	released
Alaska	56.691	-131.931	11.0	5.3	null	Male	Adult	Minnow Trap	released
Alaska	56.720	-132.016	8.0	4.3	null	Female	Adult	Hand	released
Alaska	56.719	-132.015	6.0	4.0	null	null	Juvenile	Hand	released
Alaska	56.194	-132.015	5.7	4.1	null	null	Juvenile	Hand	released
Alaska	56.719	-132.015	null	null	null	null	Juvenile	null	released
Alaska	56.719	-132.015	4.7	3.5	null	null	Juvenile	Hand	released
Alaska	56.670	-131.894	16.0	6.6	null	Male	Adult	Hand	released
Alaska	56.690	-131.931	12.0	5.2	null	Male	Adult	Hand	released
Alaska	56.690	-131.931	0.0	1.0	null	null	Egg	Hand	released
Alaska	56.719	-132.016	2.7	3.0	null	null	Juvenile	Hand	released
Alaska	56.690	-131.931	9.0	4.9	null	Male	Adult	Hand	released
Alaska	56.690	-131.931	0.0	1.0	null	null	Egg	Hand	released
Alaska	56.690	-131.931	19.0	5.8	null	Male	Adult	Hand	released
Alaska	56.701	-132.260	34.0	7.2	0.0	Male	Adult	Hand	released
Alaska	56.818	-132.943	null	null	null	null	Juvenile	Observation	released
Alaska	56.821	-132.939	null	null	null	null	Adult	Observation	released
Alaska	56.815	-132.944	null	null	null	null	Juvenile	Observation	released
Alaska	56.815	-132.944	null	null	null	null	Juvenile	Observation	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location	State / Province
634	*Rana luteiventris*	2014-09-07T15:00:00	Observation	Baseballfield Muskegs	Stikine River	Alaska
637	*Rana luteiventris*	2014-09-07T15:10:00	Photograph	Baseballfield Muskegs	Stikine River	Alaska
638	*Rana luteiventris*	2014-09-07T15:10:00	Photograph	Baseballfield Muskegs	Stikine River	Alaska
639	*Rana luteiventris*	2014-09-07T15:10:00	Observation	Baseballfield Muskegs	Stikine River	Alaska
641	*Rana luteiventris*	2014-09-07T15:45:00	Observation	Baseballfield Muskegs	Stikine River	Alaska
640	*Rana luteiventris*	2014-09-07T17:00:00	Observation	Baseballfield Muskegs	Stikine River	Alaska
626	*Rana luteiventris*	2014-09-08T15:54:00	Photograph	Mallard Slough	Stikine River	Alaska
617	*Rana luteiventris*	2014-09-09T09:22:00	Photograph	Cheliped Bay	Stikine River	Alaska
618	*Rana luteiventris*	2014-09-09T09:48:00	Photograph	Cheliped Bay	Stikine River	Alaska
620	*Rana luteiventris*	2014-09-09T10:22:00	Photograph	Cheliped Bay	Stikine River	Alaska
621	*Rana luteiventris*	2014-09-09T10:30:00	Photograph	Cheliped Bay	Stikine River	Alaska
493	*Rana palustris*	2013-8-10T00:00:00	Photograph	Lutherlyn Camp	Prospect	Pennsylvania
69	*RANA spp*	2012-05-16T13:18:00	Photograph	Mallard Slough	Stikine River	Alaska
145	*RANA spp*	2012-05-21T12:50:00	Photograph	null	Mitkof Island	Alaska
146	*RANA spp*	2012-05-21T13:55:00	Photograph	null	Mitkof Island	Alaska
129	*RANA spp*	2012-05-22T05:43:00	Observation	Farm Island	Stikine River	Alaska
3	*Taricha granulosa*	2010-05-30T18:15:00	photograph	Sand Hill Crane Lakes	Mitkof Island	Alaska
4	*Taricha granulosa*	2010-05-30T18:25:00	photograph	Sand Hill Crane Lakes	Mitkof Island	Alaska
6	*Taricha granulosa*	2010-06-07T17:00:00	photograph	Cabin Creek	Mitkof Island	Alaska
7	*Taricha granulosa*	2010-06-07T17:00:00	photograph	Cabin Creek	Mitkof Island	Alaska
8	*Taricha granulosa*	2010-06-07T17:00:00	photograph	Cabin Creek	Mitkof Island	Alaska
9	*Taricha granulosa*	2010-06-08T08:30:00	photograph	Cabin Creek	Mitkof Island	Alaska
10	*Taricha granulosa*	2010-06-08T08:45:00	photograph	Cabin Creek	Mitkof Island	Alaska
11	*Taricha granulosa*	2010-06-08T08:45:00	photograph	Cabin Creek	Mitkof Island	Alaska
14	*Taricha granulosa*	2010-06-15T10:00:00	photograph	Thoms Lake	Wrangell Island	Alaska
15	*Taricha granulosa*	2010-06-15T10:20:00	photograph	null	Wrangell Island	Alaska
16	*Taricha granulosa*	2010-06-16T22:00:00	photograph	Long Lake	Wrangell Island	Alaska
17	*Taricha granulosa*	2010-06-17T08:00:00	photograph	Long Lake	Wrangell Island	Alaska
18	*Taricha granulosa*	2010-06-17T09:00:00	photograph	Long Lake	Wrangell Island	Alaska
19	*Taricha granulosa*	2010-06-17T10:00:00	photograph	Long Lake	Wrangell Island	Alaska
20	*Taricha granulosa*	2010-06-17T10:00:00	photograph	Long Lake	Wrangell Island	Alaska
22	*Taricha granulosa*	2010-06-24T14:00:00	photograph	Mill Creek Trail	Virginia Lake	Alaska
23	*Taricha granulosa*	2010-06-24T14:00:00	photograph	Mill Creek Trail	Virginia Lake	Alaska
24	*Taricha granulosa*	2010-06-24T14:00:00	photograph	Mill Creek Trail	Virginia Lake	Alaska
25	*Taricha granulosa*	2010-06-24T14:00:00	photograph	Mill Creek Trail	Virginia Lake	Alaska
26	*Taricha granulosa*	2010-06-24T14:00:00	photograph	Mill Creek Trail	Virginia Lake	Alaska
27	*Taricha granulosa*	2010-06-24T14:00:00	photograph	Mill Creek Trail	Virginia Lake	Alaska
28	*Taricha granulosa*	2010-06-24T14:00:00	photograph	Mill Creek Trail	Virginia Lake	Alaska
30	*Taricha granulosa*	2010-06-25T12:15:00	photograph	Mill Creek Trail	Virginia Lake	Alaska
31	*Taricha granulosa*	2010-06-25T12:15:00	photograph	Mill Creek Trail	Virginia Lake	Alaska
32	*Taricha granulosa*	2010-06-25T12:15:00	photograph	Mill Creek Trail	Virginia Lake	Alaska

Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
56.816	-132.944	null	null	null	null	Juvenile	Observation	released
56.815	-132.937	null	null	null	null	Adult	Observation	released
56.815	-132.935	null	null	null	null	Juvenile	Observation	released
56.813	-132.931	null	null	null	null	Juvenile	Observation	released
56.812	-132.936	null	null	null	null	Juvenile	Observation	released
56.813	-132.936	null	null	null	null	Juvenile	Observation	released
56.711	-132.533	17.0	2.9	null	null	Juvenile	Hand	released
56.715	-132.553	2.0	2.5	null	null	Juvenile	Minnow Trap	released
56.715	-132.554	30.0	6.6	null	Male	Adult	Dipnet	released
56.716	-132.552	36.0	7.2	null	Female	Adult	Hand	released
56.715	-132.552	3.0	2.7	null	null	Tadpole	Dipnet	released
40.884	-80.032	null	null	null	null	Adult	observation	released
56.710	-132.534	NA	null	null	null	Eggs	Observational	released
56.811	-132.929	-	null	null	null	Eggs	Observational	released
56.813	-132.940	-	null	null	null	Eggs	Observational	released
56.642	-132.455	-	null	null	null	Adult	Observational	released
56.669	-132.679	null	5.0	null	female	adult	Observational	released
56.670	-132.679	null	6.0	null	male	adult	Observational	released
56.769	-132.812	10.3	7.3	null	male	adult	Minnow Trap	released
56.769	-132.812	9.0	6.5	null	female	adult	Minnow Trap	released
56.769	-132.812	13.7	7.0	null	male	adult	Minnow Trap	in collection
56.771	-132.807	11.8	7.0	null	male	adult	Minnow Trap	released
56.771	-132.807	5.7	6.0	null	female	adult	Minnow Trap	in collection
56.771	-132.807	8.4	6.8	null	male	adult	Minnow Trap	released
56.254	-132.268	6.5	6.3	null	female	adult	Minnow Trap	in collection
56.269	-132.326	8.1	6.5	null	male	adult	Minnow Trap	in collection
56.269	-132.324	3.3	5.0	null	unknown	juvenile	Observational	in collection
56.269	-132.324	1.4	3.5	null	unknown	juvenile	Observational	released
56.274	-132.119	4.8	5.8	null	female	adult	Minnow Trap	in collection
56.277	-132.122	7.1	6.0	null	female	adult	Minnow Trap	in collection
56.327	-132.154	7.3	6.0	null	male	adult	Minnow Trap	released
56.468	-132.197	12.1	7.0	10.3	male	adult	Observational	in collection
56.468	-132.197	4.7	5.3	6.8	female	adult	Observational	released
56.468	-132.197	14.0	7.5	10.5	male	adult	Observational	released
56.468	-132.197	10.7	7.5	9.5	male	adult	Observational	released
56.468	-132.197	10.9	7.0	9.0	male	adult	Observational	released
56.468	-132.197	12.7	7.5	10.8	male	adult	Observational	released
56.468	-132.197	5.9	6.0	7.3	female	adult	Observational	in collection
56.468	-132.197	6.9	6.0	8.3	male	adult	Minnow Trap	released
56.468	-132.197	11.9	6.5	10.5	male	adult	Minnow Trap	released
56.468	-132.197	8.4	6.5	8.8	female	adult	Observational	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location	State / Province
33	*Taricha granulosa*	2010-06-25T12:15:00	photograph	Mill Creek Trail	Virginia Lake	Alaska
34	*Taricha granulosa*	2010-06-25T12:15:00	observation	Mill Creek Trail	Virginia Lake	Alaska
35	*Taricha granulosa*	2010-06-26T19:00:00	observation	Middle Ridge Cabin	Wrangell Island	Alaska
36	*Taricha granulosa*	2010-06-27T12:45:00	observation	Middle Ridge Cabin	Wrangell Island	Alaska
38	*Taricha granulosa*	2010-07-08T09:15:00	photograph	N. Wrangell Trail	Wrangell Island	Alaska
39	*Taricha granulosa*	2010-07-08T09:20:00	photograph	N. Wrangell Trail	Wrangell Island	Alaska
40	*Taricha granulosa*	2010-07-10T15:30:00	photograph	Wrangell Resevoir	Wrangell Island	Alaska
41	*Taricha granulosa*	2010-07-10T15:40:00	photograph	Wrangell Resevoir	Wrangell Island	Alaska
42	*Taricha granulosa*	2010-07-10T15:50:00	photograph	Wrangell Resevoir	Wrangell Island	Alaska
43	*Taricha granulosa*	2010-07-10T16:10:00	photograph	Wrangell Resevoir	Wrangell Island	Alaska
44	*Taricha granulosa*	2010-07-10T16:10:00	photograph	Wrangell Resevoir	Wrangell Island	Alaska
45	*Taricha granulosa*	2010-07-10T16:20:00	photograph	Wrangell Resevoir	Wrangell Island	Alaska
48	*Taricha granulosa*	2010-07-15T15:00:00	observation	Ideal Cove	Mitkof Island	Alaska
49	*Taricha granulosa*	2010-07-15T15:00:00	observation	Ideal Cove	Mitkof Island	Alaska
50	*Taricha granulosa*	2010-07-15T15:00:00	observation	Ideal Cove	Mitkof Island	Alaska
51	*Taricha granulosa*	2010-07-15T15:00:00	observation	Ideal Cove	Mitkof Island	Alaska
52	*Taricha granulosa*	2010-07-15T15:00:00	observation	Ideal Cove	Mitkof Island	Alaska
58	*Taricha granulosa*	2010-07-21T08:45:00	photograph	Klawock	Prince of Wales Island	Alaska
59	*Taricha granulosa*	2010-07-21T08:45:00	photograph	Klawock	Prince of Wales Island	Alaska
60	*Taricha granulosa*	2010-07-21T08:45:00	photograph	Klawock	Prince of Wales Island	Alaska
61	*Taricha granulosa*	2010-07-21T08:45:00	photograph	Klawock	Prince of Wales Island	Alaska
94	*Taricha granulosa*	2012-05-17T15:38:00	Photograph	Twin Lakes Warm Springs	Stikine River	Alaska
95	*Taricha granulosa*	2012-05-17T15:38:00	Photograph	Twin Lakes Warm Springs	Stikine River	Alaska
96	*Taricha granulosa*	2012-05-17T15:38:00	Photograph	Twin Lakes Warm Springs	Stikine River	Alaska
97	*Taricha granulosa*	2012-05-17T15:38:00	Photograph	Twin Lakes Warm Springs	Stikine River	Alaska
98	*Taricha granulosa*	2012-05-17T15:38:00	Photograph	Twin Lakes Warm Springs	Stikine River	Alaska
99	*Taricha granulosa*	2012-05-17T16:25:00	Photograph	Twin Lakes	Stikine River	Alaska
107	*Taricha granulosa*	2012-05-18T11:00:00	Photograph	Twin Lakes	Stikine River	Alaska
108	*Taricha granulosa*	2012-05-18T11:14:00	Observation	Twin Lakes	Stikine River	Alaska
115	*Taricha granulosa*	2012-05-18T14:14:00	Photograph	Twin Lakes	Stikine River	Alaska
116	*Taricha granulosa*	2012-05-18T14:14:00	Photograph	Twin Lakes	Stikine River	Alaska
147	*Taricha granulosa*	2012-06-17T21:00:00	Photograph	null	Wrangell Island	Alaska

Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
56.468	-132.197	6.2	6.0	8.0	female	adult	Observational	released
56.468	-132.197	10.2	7.3	10.3	male	adult	Observational	released
56.363	-132.283	9.2	6.5	8.8	male	adult	Observational	released
56.363	-132.283	7.5	6.3	8.8	female	adult	Minnow Trap	in collection
56.449	-132.312	3.3	4.8	5.3	unknown	juvenile	Observational	released
56.449	-132.212	9.0	6.8	9.5	female	adult	Observational	in collection
56.458	-132.376	5.4	5.5	4.5	female	adult	Observational	in collection
56.460	-132.375	5.2	5.0	6.5	female	adult	Observational	released
56.458	-132.368	4.5	5.0	6.8	female	adult	Observational	released
56.461	-132.362	3.0	4.8	6.5	unknown	juvenile	Observational	released
56.461	-132.362	2.4	4.5	5.0	unknown	juvenile	Observational	released
56.461	-132.362	2.1	3.8	5.0	unknown	juvenile	Observational	released
56.660	-132.641	4.2	5.0	6.3	female	adult	Observational	released
56.660	-132.641	4.0	5.0	6.0	female	adult	Observational	released
56.660	-132.641	3.6	5.0	6.0	female	adult	Observational	released
56.660	-132.641	1.7	3.8	4.5	unknown	juvenile	Observational	released
56.660	-132.641	2.9	4.3	4.8	unknown	juvenile	Observational	released
55.605	-131.013	5.9	5.3	7.8	female	adult	Minnow Trap	in collection
55.605	-131.013	9.0	6.5	9.3	female	adult	Minnow Trap	released
55.605	-131.013	9.0	6.5	8.3	female	adult	Minnow Trap	released
55.605	-131.013	7.5	6.0	7.8	female	adult	Minnow Trap	released
56.701	-132.283	13.072	6.6	11.0	Male	Adult	Observational	released
56.701	-132.283	10.7	6.0	8.1	Female	Adult	Observational	released
56.701	-132.283	16.9	7.4	12.2	Male	Adult	Observational	released
56.701	-132.283	10.6	7.0	9.3	Male	Adult	Observational	released
56.701	-132.283	8.2	5.4	7.9	Female	Adult	Observational	released
56.700	-132.283	13.6	6.6	7.6	Female	Adult	Observational	released
56.707	-132.259	11.8	5.8	8.0	Female	Adult	Observational	released
56.707	-132.259	8.3	6.4	7.1	null	Adult	Observational	released
56.700	-132.264	11.2	6.3	8.3	null	Adult	Observational	released
56.700	-132.264	8.2	5.8	6.2	Female	Adult	Observational	released
56.475	-132.350	-	4.5	5.0	null	Subadult	Observational	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location	State / Province
148	*Taricha granulosa*	2012-06-17T21:11:00	Photograph	null	Wrangell Island	Alaska
149	*Taricha granulosa*	2012-06-18T16:40:00	Photograph	null	Wrangell Island	Alaska
151	*Taricha granulosa*	2012-06-18T21:00:00	Photograph	null	Wrangell Island	Alaska
155	*Taricha granulosa*	2012-06-18T21:20:00	Photograph	null	Wrangell Island	Alaska
157	*Taricha granulosa*	2012-06-19T11:13:00	Photograph	null	Wrangell Island	Alaska
159	*Taricha granulosa*	2012-06-19T11:13:00	Observation	null	Wrangell Island	Alaska
160	*Taricha granulosa*	2012-06-19T11:40:00	Photograph	null	Wrangell Island	Alaska
161	*Taricha granulosa*	2012-06-19T11:54:00	Photograph	null	Wrangell Island	Alaska
162	*Taricha granulosa*	2012-06-19T11:54:00	Photograph	null	Wrangell Island	Alaska
163	*Taricha granulosa*	2012-06-19T12:10:00	Photograph	null	Wrangell Island	Alaska
164	*Taricha granulosa*	2012-06-19T12:10:00	Photograph	null	Wrangell Island	Alaska
165	*Taricha granulosa*	2012-06-19T12:21:00	Photograph	null	Wrangell Island	Alaska
166	*Taricha granulosa*	2012-06-19T12:46:00	Photograph	null	Wrangell Island	Alaska
167	*Taricha granulosa*	2012-06-19T12:46:00	Photograph	null	Wrangell Island	Alaska
168	*Taricha granulosa*	2012-06-19T14:35:00	Photograph	null	Wrangell Island	Alaska
169	*Taricha granulosa*	2012-06-19T14:50:00	Photograph	null	Wrangell Island	Alaska
170	*Taricha granulosa*	2012-06-19T14:50:00	Photograph	null	Wrangell Island	Alaska
171	*Taricha granulosa*	2012-06-19T14:50:00	Photograph	null	Wrangell Island	Alaska
172	*Taricha granulosa*	2012-06-19T14:50:00	Photograph	null	Wrangell Island	Alaska
173	*Taricha granulosa*	2012-06-19T14:50:00	Photograph	null	Wrangell Island	Alaska
174	*Taricha granulosa*	2012-06-19T14:50:00	Photograph	null	Wrangell Island	Alaska
175	*Taricha granulosa*	2012-06-19T14:50:00	Photograph	null	Wrangell Island	Alaska
176	*Taricha granulosa*	2012-06-19T14:50:00	Photograph	null	Wrangell Island	Alaska
177	*Taricha granulosa*	2012-06-19T14:50:00	Photograph	null	Wrangell Island	Alaska
178	*Taricha granulosa*	2012-06-20T13:26:00	Photograph	null	Wrangell Island	Alaska
180	*Taricha granulosa*	2012-06-20T14:15:00	Photograph	null	Wrangell Island	Alaska
181	*Taricha granulosa*	2012-06-20T14:15:00	Photograph	null	Wrangell Island	Alaska
182	*Taricha granulosa*	2012-06-20T14:15:00	Photograph	null	Wrangell Island	Alaska
183	*Taricha granulosa*	2012-06-20T14:15:00	Photograph	null	Wrangell Island	Alaska
184	*Taricha granulosa*	2012-06-20T14:15:00	Photograph	null	Wrangell Island	Alaska
185	*Taricha granulosa*	2012-06-20T14:15:00	Photograph	null	Wrangell Island	Alaska
186	*Taricha granulosa*	2012-06-20T14:15:00	Photograph	null	Wrangell Island	Alaska
187	*Taricha granulosa*	2012-06-20T14:15:00	Photograph	null	Wrangell Island	Alaska
188	*Taricha granulosa*	2012-06-20T15:05:00	Photograph	null	Wrangell Island	Alaska
189	*Taricha granulosa*	2012-06-20T15:20:00	Photograph	null	Wrangell Island	Alaska
190	*Taricha granulosa*	2012-06-20T15:36:00	Photograph	null	Wrangell Island	Alaska
191	*Taricha granulosa*	2012-06-20T15:36:00	Photograph	null	Wrangell Island	Alaska
192	*Taricha granulosa*	2012-06-20T15:56:00	Photograph	null	Wrangell Island	Alaska
193	*Taricha granulosa*	2012-06-20T15:56:00	Photograph	null	Wrangell Island	Alaska
194	*Taricha granulosa*	2012-06-20T15:56:00	Photograph	null	Wrangell Island	Alaska
195	*Taricha granulosa*	2012-06-20T16:08:00	Observation	null	Wrangell Island	Alaska
150	*Taricha granulosa*	2012-06-20T16:28:00	Photograph	null	Wrangell Island	Alaska
196	*Taricha granulosa*	2012-06-20T16:28:00	Observation	null	Wrangell Island	Alaska
179	*Taricha granulosa*	2012-06-20T23:26:00	Photograph	null	Wrangell Island	Alaska
232	*Taricha granulosa*	2013-06-01T16:59:00	Photograph	Paradise Slough	Stikine River	Alaska
233	*Taricha granulosa*	2013-06-01T16:59:00	Photograph	Paradise Slough	Stikine River	Alaska
235	*Taricha granulosa*	2013-06-02T07:00:00	Photograph	Paradise Slough	Stikine River	Alaska
236	*Taricha granulosa*	2013-06-02T07:00:00	Photograph	Paradise Slough	Stikine River	Alaska
237	*Taricha granulosa*	2013-06-02T07:00:00	Photograph	Paradise Slough	Stikine River	Alaska

Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
56.475	-132.350	-	5.2	6.1	Female	Adult	Observational	released
56.459	-132.375	3.3	3.8	4.4	null	Subadult	Observational	released
56.477	-132.356	1.0	2.4	2.9	null	Larva	Observational	released
56.477	-132.356	1.2	2.5	2.8	null	Larva	Observational	released
56.324	-132.280	9.3	6.0	9.2	Male	Adult	Observational	released
56.324	-132.280	-	null	null	null	Adult	Observational	released
56.324	-132.282	4.9	4.9	5.8	Female	Adult	Observational	released
56.325	-132.282	4.9	5.2	5.6	Female	Adult	Observational	released
56.325	-132.282	5.4	5.2	6.5	Female	Adult	Observational	released
56.325	-132.282	9.5	6.1	9.2	Male	Adult	Observational	released
56.325	-132.282	5.4	5.9	6.6	null	Adult	Observational	released
56.326	-132.281	11.6	6.8	10.2	Female	Adult	Observational	released
56.326	-132.279	8.2	6.9	7.6	Male	Adult	Observational	released
56.326	-132.279	9.0	6.3	8.0	Male	Adult	Observational	released
56.352	-132.336	8.4	5.2	7.5	Female	Adult	Observational	released
56.352	-132.336	11.6	6.3	10.3	Male	Adult	Observational	released
56.352	-132.336	7.8	5.2	7.5	Female	Adult	Observational	released
56.352	-132.336	9.5	6.5	8.9	Male	Adult	Observational	released
56.352	-132.336	10.4	6.2	9.0	Male	Adult	Observational	released
56.352	-132.336	18.3	7.5	12.0	Male	Adult	Observational	released
56.352	-132.336	14.2	6.9	9.7	Male	Adult	Observational	released
56.352	-132.336	15.2	6.6	10.0	Male	Adult	Observational	released
56.352	-132.336	15.0	6.7	9.2	Male	Adult	Observational	released
56.352	-132.336	10.3	6.0	9.4	Female	Adult	Observational	released
56.455	-132.371	4.7	4.8	5.4	null	Subadult	Observational	released
56.461	-132.362	10.2	6.2	9.0	Male	Adult	Observational	released
56.461	-132.362	6.2	5.2	7.5	Female	Adult	Observational	released
56.461	-132.362	4.8	4.6	5.1	Female	Adult	Observational	released
56.461	-132.362	5.5	5.3	7.1	Female	Adult	Observational	released
56.461	-132.362	9.4	5.7	8.5	Female	Adult	Observational	released
56.461	-132.362	8.9	6.6	9.0	Male	Adult	Observational	released
56.461	-132.362	10.7	6.9	9.3	Male	Adult	Observational	released
56.461	-132.362	8.8	5.9	7.2	Male	Adult	Observational	released
56.460	-132.362	2.5	3.7	3.2	null	Juvenile	Observational	released
56.462	-132.363	4.0	4.6	5.0	null	Subadult	Observational	released
56.462	-132.362	4.4	5.2	5.9	Female	Adult	Observational	released
56.462	-132.362	4.8	4.9	7.3	Female	Adult	Observational	released
56.463	-132.359	10.0	6.2	8.2	Male	Adult	Observational	released
56.463	-132.359	10.3	6.4	10.0	Female	Adult	Observational	released
56.463	-132.359	9.2	6.3	9.0	Female	Adult	Observational	released
56.464	-132.358	-	null	null	null	Adult	Observational	released
56.457	-132.370	5.5	4.8	5.5	Female	Adult	Observational	released
56.457	-132.370	5.5	4.8	5.5	Female	Adult	Observational	released
56.455	-132.371	4.0	4.6	5.2	null	Subadult	Observational	released
56.690	-131.931	14.5	7.7	10.4	Male	Adult	minnow trap	released
56.690	-131.931	18.9	7.6	10.2	Male	Adult	minnow trap	released
56.691	-131.931	14.3	7.0	8.3	Female	Adult	minnow trap	released
56.691	-131.931	11.6	6.1	7.6	Female	Adult	minnow trap	released
56.691	-131.931	9.1	6.4	6.7	Female	Adult	minnow trap	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location	State / Province
238	*Taricha granulosa*	2013-06-02T07:50:00	Photograph	Paradise Slough	Stikine River	Alaska
239	*Taricha granulosa*	2013-06-02T07:50:00	Photograph	Paradise Slough	Stikine River	Alaska
240	*Taricha granulosa*	2013-06-02T07:50:00	Photograph	Paradise Slough	Stikine River	Alaska
241	*Taricha granulosa*	2013-06-02T07:50:00	Photograph	Paradise Slough	Stikine River	Alaska
246	*Taricha granulosa*	2013-06-02T10:11:00	Photograph	Paradise Slough	Stikine River	Alaska
252	*Taricha granulosa*	2013-06-02T12:57:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
260	*Taricha granulosa*	2013-06-02T20:00:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
261	*Taricha granulosa*	2013-06-02T20:00:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
262	*Taricha granulosa*	2013-06-02T20:00:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
263	*Taricha granulosa*	2013-06-02T20:00:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
264	*Taricha granulosa*	2013-06-02T20:15:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
265	*Taricha granulosa*	2013-06-02T20:15:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
266	*Taricha granulosa*	2013-06-03T09:50:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
267	*Taricha granulosa*	2013-06-03T09:50:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
268	*Taricha granulosa*	2013-06-03T09:50:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
269	*Taricha granulosa*	2013-06-03T09:50:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
270	*Taricha granulosa*	2013-06-03T10:10:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
271	*Taricha granulosa*	2013-06-03T10:10:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
272	*Taricha granulosa*	2013-06-03T10:10:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
273	*Taricha granulosa*	2013-06-03T10:10:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
274	*Taricha granulosa*	2013-06-03T10:10:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
275	*Taricha granulosa*	2013-06-03T10:10:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
276	*Taricha granulosa*	2013-06-03T10:10:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
277	*Taricha granulosa*	2013-06-03T10:10:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
278	*Taricha granulosa*	2013-06-03T10:10:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
279	*Taricha granulosa*	2013-06-03T10:10:00	Observation	Shakes Hot Springs	Stikine River	Alaska
330	*Taricha granulosa*	2013-06-04T09:20:00	Organism / Photograph	Twin Lakes Warm Spring	Stikine River	Alaska

Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
56.691	-131.931	17.3	8.0	11.2	Male	Adult	minnow trap	released
56.691	-131.931	20.0	8.5	10.9	Male	Adult	minnow trap	released
56.691	-131.931	15.6	7.1	8.7	Female	Adult	minnow trap	released
56.691	-131.931	18.0	7.0	11.0	Male	Adult	minnow trap	released
56.697	-131.945	11.2	6.0	7.5	Female	Adult	observation	released
56.719	-132.015	13.4	6.6	7.1	Female	Adult	observation	released
56.719	-132.016	11.6	6.0	8.3	Female	Adult	minnow trap	released
56.719	-132.016	11.5	6.2	7.2	Female	Adult	minnow trap	released
56.719	-132.016	11.5	5.9	8.2	Male	Adult	minnow trap	released
56.719	-132.016	9.3	6.7	8.0	Male	Adult	minnow trap	released
56.719	-132.016	10.9	6.2	7.0	Female	Adult	minnow trap	released
56.719	-132.016	14.4	6.5	8.5	Female	Adult	observation	released
56.719	-132.015	19.6	7.7	10.2	Male	Adult	minnow trap	released
56.719	-132.015	12.6	7.2	9.8	Male	Adult	minnow trap	released
56.719	-132.015	13.5	6.2	8.9	Female	Adult	minnow trap	released
56.719	-132.015	11.9	6.2	8.1	Female	Adult	minnow trap	released
56.719	-132.015	18.6	7.0	10.0	Female	Adult	minnow trap	released
56.719	-132.015	10.2	6.6	9.2	Male	Adult	minnow trap	released
56.719	-132.015	16.8	7.1	8.3	Female	Adult	minnow trap	released
56.719	-132.015	8.2	5.6	7.0	Female	Adult	minnow trap	released
56.719	-132.015	null	7.5	11.5	Male	Adult	minnow trap	released
56.719	-132.015	14.3	7.1	8.1	Female	Adult	minnow trap	released
56.719	-132.015	11.0	6.5	8.3	Female	Adult	minnow trap	released
56.719	-132.015	16.1	6.4	8.3	Female	Adult	minnow trap	released
56.719	-132.015	12.3	6.6	7.6	Female	Adult	minnow trap	released
56.719	-132.015	null	null	null	null	Adult	minnow trap	released
56.719	-132.015	8.9	6.9	8.2	Male	Adult	minnow trap	in collection

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location	State / Province
331	*Taricha granulosa*	2013-06-04T09:20:00	Organism / Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
341	*Taricha granulosa*	2013-06-04T09:20:00	Organism / Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
343	*Taricha granulosa*	2013-06-04T09:20:00	Organism / Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
344	*Taricha granulosa*	2013-06-04T09:20:00	Organism / Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
328	*Taricha granulosa*	2013-06-04T14:30:00	Photograph	Twin Lakes	Stikine River	Alaska
329	*Taricha granulosa*	2013-06-04T14:41:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
332	*Taricha granulosa*	2013-06-05T09:40:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
333	*Taricha granulosa*	2013-06-05T09:40:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
334	*Taricha granulosa*	2013-06-05T09:40:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
335	*Taricha granulosa*	2013-06-05T09:40:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
336	*Taricha granulosa*	2013-06-05T09:40:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
337	*Taricha granulosa*	2013-06-05T09:40:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
338	*Taricha granulosa*	2013-06-05T09:40:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
339	*Taricha granulosa*	2013-06-05T09:40:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
340	*Taricha granulosa*	2013-06-05T09:40:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
342	*Taricha granulosa*	2013-06-05T10:20:00	Organism / Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
345	*Taricha granulosa*	2013-06-05T10:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
346	*Taricha granulosa*	2013-06-05T10:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
347	*Taricha granulosa*	2013-06-05T10:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
348	*Taricha granulosa*	2013-06-05T10:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
349	*Taricha granulosa*	2013-06-05T10:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
350	*Taricha granulosa*	2013-06-05T10:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
351	*Taricha granulosa*	2013-06-05T10:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
352	*Taricha granulosa*	2013-06-05T10:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
353	*Taricha granulosa*	2013-06-05T10:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska

Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
56.719	-132.015	12.8	7.1	10.0	Male	Adult	minnow trap	in collection
56.719	-132.015	14.3	7.8	10.5	Male	Adult	minnow trap	in collection
56.719	-132.015	8.6	7.0	8.5	Male	Subadult	minnow trap	in collection
56.719	-132.015	7.3	5.8	9.7	Male	Subadult	minnow trap	in collection
56.701	-132.274	null	6.7	11.1	Male	Adult	observation	released
56.701	-132.284	8.8	5.6	8.3	null	Subadult	observation	released
56.701	-132.283	9.9	5.7	7.9	Female	Adult	minnow trap	released
56.701	-132.283	11.0	7.0	8.6	Male	Adult	minnow trap	released
56.701	-132.283	13.2	6.6	10.3	Male	Adult	minnow trap	released
56.701	-132.283	15.2	7.0	10.4	Male	Adult	minnow trap	released
56.701	-132.283	6.3	5.7	6.7	Male	Subadult	minnow trap	released
56.701	-132.283	13.2	7.1	10.2	Male	Adult	minnow trap	released
56.701	-132.283	14.2	7.6	10.0	Male	Adult	minnow trap	released
56.701	-132.283	8.8	7.8	7.8	null	Subadult	minnow trap	released
56.701	-132.283	9.1	8.1	8.1	null	Subadult	minnow trap	released
56.701	-132.283	14.6	7.2	10.1	Male	Adult	minnow trap	eld elsewhere
56.701	-132.283	17.1	7.7	11.1	Male	Adult	minnow trap	released
56.701	-132.283	13.0	7.2	11.6	Male	Adult	minnow trap	released
56.701	-132.283	10.0	6.9	10.4	null	Subadult	minnow trap	released
56.701	-132.283	15.6	6.6	8.6	Female	Adult	minnow trap	released
56.701	-132.283	14.8	7.1	10.6	Male	Adult	minnow trap	released
56.701	-132.283	13.9	6.8	10.6	Male	Adult	minnow trap	released
56.701	-132.283	7.9	5.7	6.7	null	Subadult	minnow trap	released
56.701	-132.283	11.7	7.4	10.9	Male	Adult	minnow trap	released
56.701	-132.283	10.3	6.6	9.1	Female	Subadult	minnow trap	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location
354	*Taricha granulosa*	2013-06-05T10:20:00	Photograph	Twin Lakes Warm Spring	Stikine River
355	*Taricha granulosa*	2013-06-05T10:20:00	Photograph	Twin Lakes Warm Spring	Stikine River
356	*Taricha granulosa*	2013-06-05T10:20:00	Photograph	Twin Lakes Warm Spring	Stikine River
357	*Taricha granulosa*	2013-06-05T11:00:00	Photograph	Twin Lakes Warm Spring	Stikine River
358	*Taricha granulosa*	2013-06-05T11:00:00	Photograph	Twin Lakes Warm Spring	Stikine River
359	*Taricha granulosa*	2013-06-05T11:00:00	Photograph	Twin Lakes Warm Spring	Stikine River
360	*Taricha granulosa*	2013-06-05T11:00:00	Photograph	Twin Lakes Warm Spring	Stikine River
361	*Taricha granulosa*	2013-06-05T11:00:00	Photograph	Twin Lakes Warm Spring	Stikine River
362	*Taricha granulosa*	2013-06-05T11:00:00	Photograph	Twin Lakes Warm Spring	Stikine River
363	*Taricha granulosa*	2013-06-05T11:00:00	Photograph	Twin Lakes Warm Spring	Stikine River
364	*Taricha granulosa*	2013-06-05T11:00:00	Photograph	Twin Lakes Warm Spring	Stikine River
365	*Taricha granulosa*	2013-06-05T11:00:00	Photograph	Twin Lakes Warm Spring	Stikine River
366	*Taricha granulosa*	2013-06-05T11:00:00	Photograph	Twin Lakes Warm Spring	Stikine River
367	*Taricha granulosa*	2013-06-05T11:00:00	Photograph	Twin Lakes Warm Spring	Stikine River
368	*Taricha granulosa*	2013-06-05T11:00:00	Photograph	Twin Lakes Warm Spring	Stikine River
369	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River
370	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River
371	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River
372	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River
373	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River
374	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River
375	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River
376	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River
377	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River

State / Province	Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
Alaska	56.701	-132.283	10.1	6.7	8.0	Female	Adult	minnow trap	released
Alaska	56.701	-132.283	14.8	6.2	8.9	Female	Adult	minnow trap	released
Alaska	56.701	-132.283	7.2	5.2	7.1	null	Subadult	minnow trap	released
Alaska	56.701	-132.283	13.9	6.7	9.0	Female	Adult	minnow trap	released
Alaska	56.701	-132.283	9.1	5.9	7.6	Female	Adult	minnow trap	released
Alaska	56.701	-132.283	8.4	6.2	7.6	Female	Adult	minnow trap	released
Alaska	56.701	-132.283	16.6	7.7	11.1	Male	Adult	minnow trap	released
Alaska	56.701	-132.283	7.0	5.7	6.6	null	Subadult	minnow trap	released
Alaska	56.701	-132.283	12.4	7.0	9.9	Female	Adult	minnow trap	released
Alaska	56.701	-132.283	10.0	6.2	7.6	Female	Adult	minnow trap	released
Alaska	56.701	-132.283	15.0	7.8	10.5	Male	Adult	minnow trap	released
Alaska	56.701	-132.283	12.4	7.4	10.1	Male	Adult	minnow trap	released
Alaska	56.701	-132.283	12.2	6.7	10.3	Male	Adult	minnow trap	released
Alaska	56.701	-132.283	15.7	7.6	11.1	Male	Adult	minnow trap	released
Alaska	56.701	-132.283	11.8	7.1	10.4	Male	Adult	minnow trap	released
Alaska	56.701	-132.283	8.9	6.4	9.8	Female	Adult	minnow trap	released
Alaska	56.701	-132.283	12.0	6.8	11.0	Male	Adult	minnow trap	released
Alaska	56.701	-132.283	10.8	6.1	8.5	Female	Adult	minnow trap	released
Alaska	56.701	-132.283	10.8	6.2	11.0	Male	Adult	minnow trap	released
Alaska	56.701	-132.283	7.7	6.1	6.8	Male	Adult	minnow trap	released
Alaska	56.701	-132.283	10.7	6.8	10.2	Male	Adult	minnow trap	released
Alaska	56.701	-132.283	10.5	6.8	11.0	Male	Adult	minnow trap	released
Alaska	56.701	-132.283	11.6	7.2	9.6	Male	Adult	minnow trap	released
Alaska	56.701	-132.283	7.5	5.4	7.6	Female	Adult	minnow trap	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location	State / Province
378	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
379	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
380	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
381	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
382	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
383	*Taricha granulosa*	2013-06-05T11:20:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
384	*Taricha granulosa*	2013-06-05T11:45:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
385	*Taricha granulosa*	2013-06-05T11:45:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
386	*Taricha granulosa*	2013-06-05T11:45:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
387	*Taricha granulosa*	2013-06-05T11:45:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
388	*Taricha granulosa*	2013-06-05T11:45:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
390	*Taricha granulosa*	2013-06-05T12:15:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
391	*Taricha granulosa*	2013-06-05T12:15:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
392	*Taricha granulosa*	2013-06-05T12:15:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
393	*Taricha granulosa*	2013-06-05T12:15:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
394	*Taricha granulosa*	2013-06-05T12:15:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
395	*Taricha granulosa*	2013-06-05T12:15:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
396	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
397	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
398	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
399	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
400	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
401	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska
402	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River	Alaska

Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
56.701	-132.283	7.7	6.3	7.6	Female	Adult	minnow trap	released
56.701	-132.283	7.4	6.1	7.6	Female	Adult	minnow trap	released
56.701	-132.283	8.4	6.1	7.3	Female	Adult	minnow trap	released
56.701	-132.283	8.9	5.8	8.7	Female	Adult	minnow trap	released
56.701	-132.283	14.1	7.4	11.0	Male	Adult	minnow trap	released
56.701	-132.283	9.5	6.6	8.7	Male	Adult	minnow trap	released
56.701	-132.283	9.9	5.9	8.6	Female	Adult	minnow trap	released
56.701	-132.283	7.6	6.0	8.0	Female	Adult	minnow trap	released
56.701	-132.283	11.5	7.8	10.5	Male	Adult	minnow trap	released
56.701	-132.283	8.0	6.2	8.6	Female	Adult	minnow trap	released
56.701	-132.283	8.1	6.1	7.4	Female	Adult	minnow trap	released
56.701	-132.283	12.7	6.4	9.0	Male	Adult	minnow trap	released
56.701	-132.283	10.6	6.7	9.2	Female	Adult	minnow trap	released
56.701	-132.283	8.1	7.4	7.4	Female	Adult	minnow trap	released
56.701	-132.283	9.6	6.1	8.1	Female	Adult	minnow trap	released
56.701	-132.283	7.6	5.7	7.4	Female	Adult	minnow trap	released
56.701	-132.283	11.4	7.2	11.4	Male	Adult	minnow trap	released
56.701	-132.284	10.9	6.9	9.7	Female	Adult	minnow trap	released
56.701	-132.284	9.7	6.2	8.6	Female	Adult	minnow trap	released
56.701	-132.284	12.6	6.2	9.1	Female	Adult	minnow trap	released
56.701	-132.284	12.2	6.7	7.4	Female	Adult	minnow trap	released
56.701	-132.284	16.1	7.3	10.1	Male	Adult	minnow trap	released
56.701	-132.284	10.8	6.0	8.0	Female	Adult	minnow trap	released
56.701	-132.284	16.4	6.5	10.6	Male	Adult	minnow trap	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location
403	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
404	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
405	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
406	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
407	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
408	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
409	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
410	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
411	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
412	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
413	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
414	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
415	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
416	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
417	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes Warm Spring	Stikine River
418	*Taricha granulosa*	2013-06-05T12:30:00	Photograph	Twin Lakes	Stikine River
510	*Taricha granulosa*	2014-05-18T10:13:00	Photograph	Barnes Lake	Stikine River
511	*Taricha granulosa*	2014-05-18T10:13:00	Photograph	Barnes Lake	Stikine River
527	*Taricha granulosa*	2014-05-19T08:33:00	Photograph	Barnes Lake	Stikine River
530	*Taricha granulosa*	2014-05-19T08:48:00	Photograph	Barnes Lake	Stikine River
531	*Taricha granulosa*	2014-05-19T08:52:00	Photograph	Barnes Lake	Stikine River
532	*Taricha granulosa*	2014-05-19T08:54:00	Photograph	Barnes Lake	Stikine River
533	*Taricha granulosa*	2014-05-19T08:58:00	Photograph	Barnes Lake	Stikine River
534	*Taricha granulosa*	2014-05-19T09:04:00	Photograph	Barnes Lake	Stikine River
536	*Taricha granulosa*	2014-05-19T09:11:00	Photograph	Barnes Lake	Stikine River
537	*Taricha granulosa*	2014-05-19T09:14:00	Photograph	Barnes Lake	Stikine River
538	*Taricha granulosa*	2014-05-19T09:24:00	Photograph	Barnes Lake	Stikine River
540	*Taricha granulosa*	2014-05-19T09:34:00	Photograph	Barnes Lake	Stikine River
541	*Taricha granulosa*	2014-05-19T09:36:00	Photograph	Barnes Lake	Stikine River
551	*Taricha granulosa*	2014-05-19T12:12:00	Photograph	Twin Lakes Warm Springs	Stikine River
552	*Taricha granulosa*	2014-05-19T15:15:00	Photograph	Twin Lakes Warm Springs	Stikine River

State / Province	Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
Alaska	56.701	-132.284	8.7	5.6	8.9	Female	Adult	minnow trap	released
Alaska	56.701	-132.284	8.4	5.6	8.1	Male	Adult	minnow trap	released
Alaska	56.701	-132.284	13.8	6.4	8.6	Male	Adult	minnow trap	released
Alaska	56.701	-132.284	14.7	7.0	10.2	Male	Adult	minnow trap	released
Alaska	56.701	-132.284	14.2	7.1	11.2	Male	Adult	minnow trap	released
Alaska	56.701	-132.284	9.5	6.0	8.6	Male	Adult	minnow trap	released
Alaska	56.701	-132.284	14.8	6.8	9.7	Male	Adult	minnow trap	released
Alaska	56.701	-132.284	15.2	7.6	10.6	Male	Adult	minnow trap	released
Alaska	56.701	-132.284	12.3	6.3	8.6	Female	Adult	minnow trap	released
Alaska	56.701	-132.284	12.6	6.4	10.0	Male	Adult	minnow trap	released
Alaska	56.701	-132.284	11.3	7.2	9.8	Female	Adult	minnow trap	released
Alaska	56.701	-132.284	####	7.3	11.2	Male	Adult	minnow trap	released
Alaska	56.701	-132.284	13.2	7.1	11.0	Male	Adult	minnow trap	released
Alaska	56.701	-132.284	13.7	7.0	9.0	Male	Adult	minnow trap	released
Alaska	56.701	-132.284	9.4	6.2	8.5	Female	Adult	minnow trap	released
Alaska	56.701	-132.276	18.5	8.2	11.0	Male	Adult	minnow trap	released
Alaska	56.672	-131.885	17.0	7.2	11.2	Male	Adult	Hand	released
Alaska	56.672	-131.885	11.0	6.2	8.2	Female	Adult	Hand	released
Alaska	56.690	-131.931	11.0	7.0	10.0	Male	Adult	Minnow Trap	released
Alaska	56.691	-131.931	20.0	8.2	12.1	Male	Adult	Minnow Trap	released
Alaska	56.691	-131.931	17.0	7.1	10.2	Female	Adult	Minnow Trap	released
Alaska	56.691	-131.931	15.0	7.2	9.8	Male	Adult	Minnow Trap	released
Alaska	56.691	-131.931	8.0	6.8	8.0	Male	Adult	Minnow Trap	released
Alaska	56.691	-131.931	15.0	6.3	10.6	Male	Adult	Minnow Trap	released
Alaska	56.691	-131.931	22.0	7.2	13.1	Male	Adult	Minnow Trap	released
Alaska	56.691	-131.931	15.0	7.0	10.2	Male	Adult	Minnow Trap	released
Alaska	56.691	-131.931	18.0	8.0	11.1	Male	Adult	Minnow Trap	released
Alaska	56.719	-132.016	12.0	7.1	null	Male	Adult	Minnow Trap	released
Alaska	56.691	-131.931	10.0	5.5	7.1	Male	Adult	Minnow Trap	released
Alaska	56.701	-132.283	10.2	6.5	9.1	Female	Adult	Hand	released
Alaska	56.701	-132.283	10.7	5.6	6.9	Female	Adult	Hand	released

Table F.1. continued…

Collection ID	Species	Date and Time	Record Type	Specific Location	General Location	State / Province
562	*Taricha granulosa*	2014-05-19T16:57:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
564	*Taricha granulosa*	2014-05-19T18:00:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
565	*Taricha granulosa*	2014-05-19T18:02:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
566	*Taricha granulosa*	2014-05-19T18:04:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
567	*Taricha granulosa*	2014-05-19T18:06:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
568	*Taricha granulosa*	2014-05-19T18:08:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
569	*Taricha granulosa*	2014-05-19T18:10:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
570	*Taricha granulosa*	2014-05-19T18:12:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
571	*Taricha granulosa*	2014-05-19T18:18:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
572	*Taricha granulosa*	2014-05-19T18:20:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
573	*Taricha granulosa*	2014-05-19T18:22:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
574	*Taricha granulosa*	2014-05-19T18:24:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
575	*Taricha granulosa*	2014-05-19T18:26:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
576	*Taricha granulosa*	2014-05-19T18:28:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
577	*Taricha granulosa*	2014-05-19T18:30:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
578	*Taricha granulosa*	2014-05-19T18:32:00	Photograph	Shakes Hot Springs	Stikine River	Alaska
585	*Taricha granulosa*	2014-05-21T07:12:00	Photograph	Twin Lakes	Stikine River	Alaska
586	*Taricha granulosa*	2014-05-21T07:20:00	Photograph	Twin Lakes	Stikine River	Alaska
590	*Taricha granulosa*	2014-05-21T08:15:00	Photograph	Twin Lakes	Stikine River	Alaska
600	*Taricha granulosa*	2014-06-06T11:46:00	Photograph	Twin Lakes	Stikine River	Alaska
601	*Taricha granulosa*	2014-06-06T12:02:00	Photograph	Twin Lakes	Stikine River	Alaska
610	*Taricha granulosa*	2014-06-07T12:00:00	Photograph	Twin Lakes	Stikine River	Alaska
611	*Taricha granulosa*	2014-06-07T12:28:00	Photograph	Twin Lakes	Stikine River	Alaska
642	*Taricha granulosa*	2015-06-23T11:55:00	Photograph	Twin Lakes	Stikine River	Alaska
645	*Taricha granulosa*	2015-06-23T13:40:00	Photograph	Twin Lakes	Stikine River	Alaska
646	*Taricha granulosa*	2015-06-23T14:11:00	Observation	Twin Lakes	Stikine River	Alaska
647	*Taricha granulosa*	2015-06-24T15:22:00	Photograph	Twin Lakes	Stikine River	Alaska
496	*Thamnophis sirtalis*	2013-8-11T00:00:00	Photograph	Keystone State Park	New Alexandria	Pennsylvania
495	*Thamnophis sirtalis sauritus*	2013-8-10T00:00:00	Photograph	Cheeseman Farm	Portersville	Pennsylvania
498	*Thamnophis spp.*	2010-8-8T00:00:00	Photograph	Locksmith Lane	Sandy	Oregon

Latitude	Longitude	Mass (g)	Snout-Vent Length (cm)	Tail Length (cm)	Sex	Age Class	Collection Method	Final Dispositon
56.719	-132.016	13.0	5.6	7.0	Female	Adult	Hand	released
56.719	-132.016	22.2	7.4	12.0	Male	Adult	Minnow Trap	released
56.719	-132.016	15.5	6.9	8.2	Female	Adult	Minnow Trap	released
56.719	-132.016	11.6	6.3	7.6	Female	Adult	Minnow Trap	released
56.719	-132.016	16.5	7.0	10.8	Male	Adult	Minnow Trap	released
56.719	-132.016	12.2	5.8	8.7	Female	Adult	Minnow Trap	released
56.719	-132.016	15.3	6.4	8.9	Female	Adult	Minnow Trap	released
56.719	-132.016	16.6	7.2	1.5	Male	Adult	Minnow Trap	released
56.719	-132.016	15.8	6.9	8.0	Female	Adult	Minnow Trap	released
56.719	-132.016	12.7	6.7	7.8	Female	Adult	Minnow Trap	released
56.719	-132.016	21.8	7.5	11.0	Male	Adult	Minnow Trap	released
56.719	-132.016	15.0	7.2	11.1	Male	Adult	Minnow Trap	released
56.719	-132.016	11.7	6.5	8.4	Female	Adult	Minnow Trap	released
56.719	-132.016	9.3	6.2	7.1	Female	Adult	Minnow Trap	released
56.719	-132.016	15.7	6.5	10.4	Female	Adult	Minnow Trap	released
56.719	-132.016	12.5	6.7	8.0	Female	Adult	Minnow Trap	released
56.701	-132.259	13.7	6.6	8.5	Female	Adult	Minnow Trap	released
56.701	-132.259	10.0	null	null	Male	Adult	Minnow Trap	released
56.702	-132.277	14.3	6.5	7.5	Female	Adult	Minnow Trap	released
56.694	-132.245	11.0	6.2	79.0	Female	Adult	Hand	released
56.700	-132.261	13.0	6.4	89.0	Female	Adult	Minnow Trap	released
56.702	-132.277	13.0	6.8	82.0	Female	Adult	Minnow Trap	released
56.702	-132.277	16.0	6.2	106.0	Female	Adult	Minnow Trap	released
56.699	-132.263	31.0	6.8	0.0	null	Adult	Hand	released
56.700	-132.261	17.0	7.0	90.0	null	Adult	Minnow Trap	released
56.701	-132.259	11.0	7.0	104.0	null	Adult	Minnow Trap	released
56.701	-132.276	15.0	6.7	79.0	null	Adult	Minnow Trap	released
40.372	-79.376	null	null	null	null	Juvenile	observation	released
40.938	-80.169	null	null	null	null	Juvenile	observation	released
45.356	-122.230	null	null	null	null	Adult	observation	released

APPENDIX G: Overview of study findings provided to the community of Wrangell, Alaska on 21 May 2015.

Document also made available at the following web address:
http://www.akherpsociety.org/projectbackground.htm.

Amphibians of the Stikine River Region

An Overview of Study Findings

June 2015

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Project Summary: This project was designed to better understand human-amphibian relationships in the Stikine River Region of Alaska, as well as how these relationships can inform the conservation and management of these species. A series of local and traditional knowledge (LTK) studies and citizen science programs were conducted between 2009 and 2015 in both Wrangell and Petersburg. In addition, annual amphibian inventories were conducted within the Stikine-LeConte Wilderness Area and nearby localities during these years. This document provides a summary of the overall data obtained from this study.

THANK-YOU! First and foremost I want to express my sincere gratitude to the residents of Wrangell and Petersburg for your endless support of this project and for your generous hospitality. I always feel at home during my visits, I have made amazing friends, and I am honored to now bear the Kiks.adi name "Xíxch'i Toowóo" meaning "Frog Feelings" or "He Who Cares for the Frogs." Elders, adults, and youth alike have helped me to become the scientist and humanist that I am today. I have truly grown as a person as a result of my time with you. I also feel a deep spiritual and emotional connection to the majestic landscapes surrounding your home, and I hope that my research has had a positive impact on local education and conservation.

AMPHIBIAN IMPORTANCE

Why are amphibians important in the Stikine River region of Alaska? While they are not commonly consumed by humans and do not apparently have economic value locally, they are important components of local ecological systems. These species provide a substantial food source for birds, small mammals, and fish. They are also considered excellent indicators of biological health given their porous skin and relative inability to migrate long-distances. They are among the first animals to be impacted by development, climate change, and environmental degradation. Monitoring amphibians can be an inexpensive and efficient means of understanding shifts in the local environment. Understanding changes to amphibian populations can therefore provide clues and early warning signs that may help to prevent detrimental impacts on species on which humans directly depend, like salmon and deer.

Amphibians are also important to local cultural groups. The Kiks.adi and Kaach.adi Clans of the Stikine Tlingit both bear the frog (or toad) as a crest and have maintained cultural relationships to these species since time immemorial. The call of the frog has guided boats in dangerous seas to shore, has served in annual calendars as a cue for preparing to move to summer fish camps, and has been used to forecast weather conditions. These animals have also been used in songs and stories that teach the interconnectedness of humans and animals, and the respect that must be given to even the smallest animals if people are to persist in the North. Furthermore, amphibians have been regarded highly for their powers of prediction and healing.

First known Long-toed Salamander at Guerin Slough. Contributed by Ethen Pempek in 2011.

Local people apply intrinsic, recreational, and educational values to amphibians. Most participants in this study recognized that amphibians are important to many different groups of people in the region. Children are often excited to see (and catch) frogs and salamanders found locally. Teachers frequently use amphibians as teaching aids in their classrooms to demonstrate metamorphosis from egg, to tadpole, to frog or salamander. Regardless of personal feelings toward these animals, this study found that many residents frequently encounter amphibians on local landscapes and that they are generally happy to see them from year to year.

HUMAN-AMPHIBIAN INTERACTIONS AND PERCEPTIONS

This topic was largely explored using a mailed survey instrument to the community of Wrangell in 2012. A total of 26% of households represented by 280 surveys were returned. These are the key findings from that survey:

- Most local residents feel at least somewhat familiar with local amphibians but relatively unfamiliar with laws pertaining to these species.
- Most residents (91%) feel that amphibians are important components of local ecological communities and to at least some groups of people (95%). Eighty-one percent of respondents indicated that amphibians are important to EVERYONE!
- Many respondents indicated that they feel enjoyment when encountering local amphibians, followed by excitement, respect, indifference, and fear.
- Respondents observe Boreal Toads on local landscapes most frequently, followed by Rough-skinned Newts, Columbia Spotted Frogs, Long-toed Salamanders, Wood Frogs, and Northwestern Salamanders.
- A large proportion of respondents (41%) have intentionally looked for amphibians in the past.
- When encountering amphibians, 60% of respondents indicated that they have handled them and 28% indicate that they handle them at least occasionally.
- Most respondents (79%) indicated that they have never moved an amphibian from one place to another, and 21% indicated that they had.
- While most respondents (78%) indicated that they have not brought a local amphibian home as a pet or to view in captivity, 22% indicated that they had. Twenty-six respondents released these animals where they were captured, and 24 respondents released them elsewhere.
- The most frequently mentioned observations of recent environmental changes included warmer winter temperatures (89 respondents), cooler summer temperatures (73 respondents), and earlier ice break-ups (36 respondents).

In addition to the above listed items, respondents also offered 862 species and place-specific observations of amphibians! Many of these are previously unknown locations for the occurrence of these animals!

EDUCATIONAL CONTRIBUTIONS

The citizen science and service-learning components of this study gave me the opportunity to give back to the communities through public lectures, curriculum development, short courses, and field training. Similarly, participants in these programs provided high quality data on local amphibians. These are a few photos of our many adventures!



Camp'Phibian 2014
Active sampling with Wrangell Girl Scout Troop # 4156 @ Twin Lakes

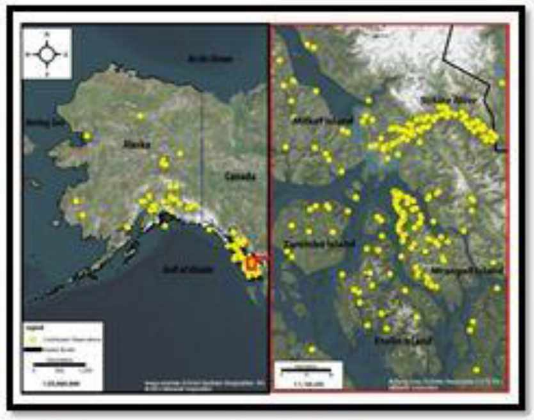
Service-Learning Program 2014
Active sampling with Petersburg Advanced Placement Biology Class @ Cheliped Bay & Mallard Slough



CONTRIBUTED OBSERVATIONS

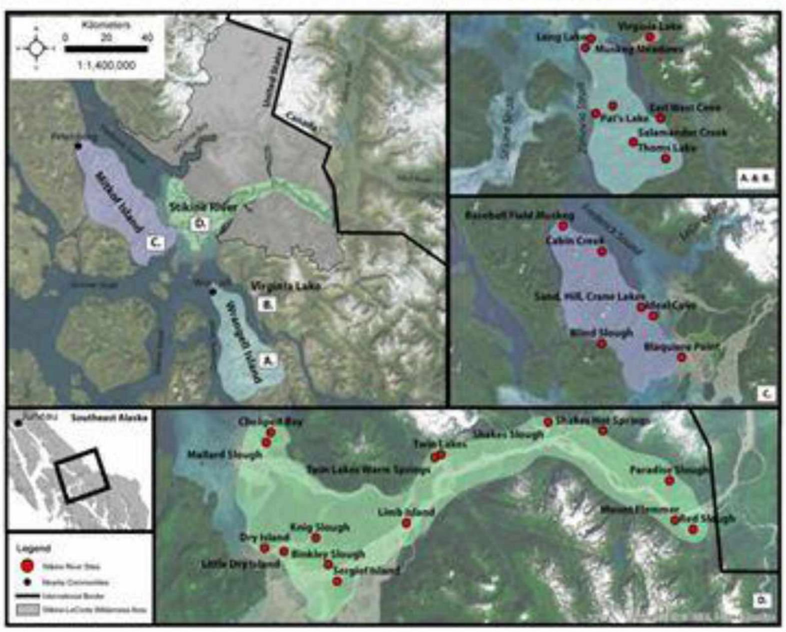
Between the contributed local knowledge observations and citizen science programs used in this study, a total of 2,320 amphibian observations were made. These contributions are listed in the table below by contribution method and by species. Amphibians highlighted in green are known to be native to Alaska. Those cells highlighted in gray are contributions from citizen science programs.

		Species												
Contribution Method	No. unique contributing households	Boreal Toad	Columbia-spotted Frog	Wood Frog	Pacific Chorus Frog	Red-legged Frog	Rough-skinned Newt	Long-toed Salamander	Northwestern Salamander	Blue-spotted Salamander	Unknown Amphibian	Unknown Frog	Unknown Salamander	TOTAL
Classroom Survey	12	1	0	0	0	0	0	0	0	0	0	13	0	14
Mailed Survey	190	271	85	50	0	0	197	42	10	0	69	120	18	862
Follow-up Survey	14	15	0	5	0	0	6	2	1	0	0	2	1	30
AHS Website	10	9	2	0	0	0	4	0	0	1	0	1	0	17
In Person	21	18	1	15	0	0	8	0	0	0	0	18	2	62
Email	26	26	0	10	1	0	9	2	0	0	0	5	0	53
U.S. Mail	1	0	0	0	0	0	0	1	0	0	0	0	0	1
SubSurveys	28	15	0	65	0	6	6	1	0	0	0	19	0	112
Camp 'Phibian 2014 / 2015	-	442	12	0	0	0	8	0	0	0	0	0	0	462
AmphibiBlitz	-	0	10	0	0	0	0	0	0	0	0	0	0	10
Service-Learning Program	-	186	477	20	0	0	0	5	0	0	0	9	0	697
TOTAL	-	982	587	163	1	6	238	53	11	1	69	188	21	2320



Contributed amphibian observations were primarily from the Stikine River region of Alaska, though some contributors provided observations from other areas. The map above represents each of the localities that amphibians were reported during this study. Most of these points represent species specific observations. For many of them, the species were originally unknown from those locations.

AMPHIBIAN INVENTORIES



In addition to local knowledge and citizen science contributions from the public, I also conducted systematic amphibian surveys during several years of this study. To the left is a map of the locations sampled.

The condensed table on the next page provides a brief overview of my findings. While this table only contains the three sampling years used for my graduate research, sampling has continued annually since. To implement this, the Alaska Herpetological Society (AHS) has created the Stikine Long-term Amphibian Monitoring Program (SLAMP).

A total of 1,325 observations, which represent thousands of individual amphibians, were observed using standard surveying methodologies between 2010 and 2014. In the data below, many eggs or tadpoles were recorded as a single observation.

	2010									2012									2013									2014									
	Boreal Toad	Wood Frog	Columbia-spotted Frog	Pacific Chorus Frog	Rough-skinned Newt	Long-toed Salamander	Northwestern Salamander	Unknown Salamander	Unknown Frog	Boreal Toad	Wood Frog	Columbia-spotted Frog	Pacific Chorus Frog	Rough-skinned Newt	Long-toed Salamander	Northwestern Salamander	Unknown Salamander	Unknown Frog	Boreal Toad	Wood Frog	Columbia-spotted Frog	Pacific Chorus Frog	Rough-skinned Newt	Long-toed Salamander	Northwestern Salamander	Unknown Salamander	Unknown Frog	Boreal Toad	Wood Frog	Columbia-spotted Frog	Pacific Chorus Frog	Rough-skinned Newt	Long-toed Salamander	Northwestern Salamander	Unknown Salamander	Unknown Frog	TOTAL
Mitkof Island	1	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	18
Stikine River	-	-	-	-	-	-	-	-	-	25	7	6	0	10	29	0	4	2	110	7	29	0	121	2	0	0	0	821	0	19	0	19	0	0	0	0	1211
Wrangell Island	6	0	0	0	15	0	0	0	0	4	0	0	0	46	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	71
Virginia Lake*	1	0	0	0	12	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
OTHER	2	0	0	2	4	4	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
Revillagigedo Island	0	0	0	2	0	4	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
Haines	2	0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Prince of Wales Island	0	0	0	0	4	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
TOTAL	10	0	0	2	46	4	0	0	0	29	7	6	0	56	29	0	6	2	110	7	29	0	121	2	0	0	0	821	0	19	0	19	0	0	0	0	1325

CONCLUSIONS

- Local knowledge and citizen science provide excellent opportunities for collaboration and data collection.
- Residents of the Stikine region value amphibians as important components of social and ecological systems.
- At least five native species of amphibians are present in the Stikine River region of Alaska.
- Many amphibian populations in this region appear to be stable, with the exception of key sites on Mitkof Island.
- This study has expanded knowledge of amphibian diversity, distribution, and abundance throughout the state.

Wood Frog at Farm Island, 2012

Rough-skinned Newt at Paradise Slough, 2013

Boreal Toad at Twin Lakes, 2014

MORE INFORMATION

The information presented here is a broad overview of the work conducted for this project. Detailed data analysis is currently pending publication in peer-reviewed journals and in my doctoral dissertation at the University of Alaska Fairbanks. These publications and much of the data will soon be available online at www.akherpsociety.org. Please feel free to contact me directly with any questions, comments, or concerns that you may have.

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